electrical PAGES 47. Contracting

Electrical Construction Industry for 20 years? Read the astonishingly simple reason on page 19.

L.K. Comstock explains how labor warfare has been stopped.

JUNE - 1941



HERE it is—your "cast-iron" answer to the splashing water and spattering liquids that make motor operation uncertain in many places. It gives you greater-than-ever protection in three important ways:



Extra Protection . . . against physical damage

One-piece cast-iron frame and end shields completely encase the motor, and offer formidable resistance to rust and corrosion. Ventilating openings are well baffled and contours of the motor shed direct-splashing water or liquids. The low-velocity air intake minimizes sucking in of the spray. Conduit box is waterproof.



Extra Protection ... against electrical breakdown

In the coil windings, the combination of Formex wire, a special synthetic-resin bond, and a tough external coat of Glyptal 1201 Red sets a new standard for resistance to moisture and to vapor in the air.



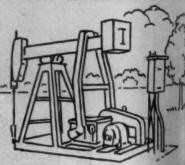
Extra Protection ... against wear and tear

Completely enclosed ball bearings of high load-carrying capacity are standard. A cast-iron enclosure protects the bearing and its lubricant. A simple but effective seal along the shaft excludes liquids from

In addition to these "extras," you get basic improvements in operating characteristics, convenience in installation, and clean-cut, compact design. Write today for Bulletin GEA-3595. Specify Tri-Clad on your next splashproof-motor order. General Electric, Schenectady, N. Y.

Splashproof MOTOR





... and in some outdoor loss tions splashproof motors ma be the answer. Ask your 6representative about Tri-Cle splashproof motors.



GENERAL & ELECTRIC



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DUAR PRODUCTION CIRCUITS

WITH WESTINGHOUSE SAFETY SWITCHES

SAVE MAINTENANCE EXCLUSIVE DIAMOND-POINTED BREAK JAW KEEPS ARCING OUTSIDE CONTACT AREA



The ordinary way.



ONE-PIECE COPPER CONSTRUCTION SAVE POWER REDUCES HEAT LOSS



copper construction saves money from power loss. Westing-ety switches have from 2 to 7 less contact points per pole.

THESE FEATURES MEAN EASIER INSTALLATION -LOWER MAINTENANCE

Concentric knock-outs, top, bottom and both sides Solderless lugs
 Reinforced fuse clips assure maximum fuse contact and reduce heating.

Warpproof, moistureproof Micarta crossbar • Steel parts cadmium-plated to resist rust and corrosion · Wearing parts of operating mechanism heat-treated for longer life . Door can be padlocked to prevent unauthorized operation • Switch operating mechanism inside handle on Type A leaves ample wiring space, prevents damage to conductor insulation • Non-carbonizing composition base . Quick-make, quick-break on Types A and C minimizes switch burning.

WESTINGHOUSE ELECTRIC & MFG. CO. BAST PITTSBURGH, PA. J-21147

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FOR PRODUCTION INSURANCE

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TIME SAVERS
FOR INDUSTRY



WESTINGHOUSE "DE-ION" LINESTARTER

Magnetic Across-the-line Starter CLASS 11-200

Push-button operated—builtin or mounted separately.
Small, compact construction
saves space. Bi-metal overload protection—hand or
automatic reset. "De-ion"
protection for contacts reduces maintenance. Vertical
magnet operation speeds contact opening and prevents
accidental operation.



WESTINGHOUSE AB-I BREAKER

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WESTINGHOUSE COMBINATION LINESTARTER

For Motor Control and Circuit Protection CLASS 11-206

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WESTINGHOUSE "DE-ION" MOTOR WATCHMAN

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You Need for High Speed Production, Precision Workmanship and Night Shifts!

Footcandles or More

NOW . . . an Equal Opportunity for All Employees to Produce at Peak Efficiency!

THE seventy-five or more footcandles of cool, diffused lighting which now can be secured with this new Benjamin Fluorescent "Lite-Line" System represent a sensational advance in general lighting levels for industry. While it is less than the amount of light which employees near the windows receive* it may be as much as

5 TIMES MORE LIGHT

than now provided employees working away from windows or on night shifts! Such high levels of illumination ranging from 50 to 100 footcandles are essential to the maximum speed and ease of seeing required to meet 1941 production demands. The effectiveness of these higher levels of illumination has been completely demonstrated by the Science of Seeing through laboratory tests and actual plant experience.

High Light Levels Now Economical

Now, with the new Benjamin Fluorescent "Lite-Line" System providing unbroken lines of light . . . row on row . . . across entire rooms, it is both possible and economical to provide higher levels of illumination without annoying heat or glare. Such lighting can equalize

the seeing ability of all employees on every shift, day and night, and give them the amount of light needed for sustained production effort. Further, it makes possible better utilization of floor space through re-arrangement of work spaces regardless of natural lighting facilities.

Capitalize on These Benefits of "Lite-Line" Lighting

With Benjamin Fluorescent "Lite-Line", you give the eyesight of all employees the best possible opportunity to keep pace with production requirements. For objects and defects invisible to the average eye in poor light become easily visible when an increased amount of lighting is provided. Light acts as a magnifier in making fine details visible and thus makes seeing easier with less effort and strain. It takes time to see. For example, laboratory tests under controlled conditions showed that an increase in lighting from one footcandle to approximately 20 footcandles tripled the speed of seeing. The time thus saved can be used to increase production quantity instead of being wasted in trying to see.

*On clear days employees working near windows receive from 150-200 footcandles of daylight.

BENJAMIA Continuous Channel Fluorescent

How This New "Lite-Line" System Enables You to Get 35 to 75 Footcandles, ECONOMICALLY!

MORE LIGHT, in a more modern form, at lower cost! There you have the essence of what is offered to you in the new Benjamin Fluorescent "Lite-Line" System. Some of the important advantages of this system are described here . . . all are detailed in the new Benjamin described here . . . all are detailed in the new Benjamin "Lite-Line" Bulletin which the coupon will bring to you.

MICH LIGHTING EFFICIENCY. "Lite-Lines" with their correctly designed reflectors and Mazda F lamps produce more than double the amount of light per watt with half the heat as is produced by incandescent equipment providing equal lighting levels.

LOWER INSTALLATION COST. Savings of 25% or more, as less outlets, conduit and fittings are required. The greater part of the branch circuit runs are made inside "Lite-Line" housing. On re-lighting jobs, major changes in existing wiring frequently are unnecessary and in all cases less rewiring is required.

SUSTAINED EFFICIENCY. Benjamin "Lite-Lines" employ a porcelain enamel reflecting surface with an initial efficiency that meets every requirement for best Fluorescent lighting. Its real advantage, however, is that this type of reflecting surface is unequalled in sustaining its efficiency throughout the years.

CONVERTIBLE. You can secure two-lamp "Lite-Line", units which contain special provision for three-lamp operation. Thus, at any time and for any part of the line, you can increase the lighting levels by 45%.

BATTLESHIP CONSTRUCTION. Built with an extra "safety factor" of strength that is essential to long life and sustained efficiency. These qualities cannot always be evaluated by examination or even laboratory tests... they are assured by Benjamin's tests... they are assured by Benjamin's work of the sustained by examination for making equipment that is "built like a battleship".

WARRANTY OF PERFORMANCE AND CONSTRUCTION

The Trade Mark

on Fluorescent lighting equipment is your assurance of correct design, heavy-duty construction and efficient performance backed by forty years of specialization in manufacturing lighting equipment for commerce and industry. Reflectors, auxiliary control equipment, sockets and other component parts of these fixtures are engineered for co-ordinated operation with Mazda Fluorescent Lamps to give maximum light output and trouble-free operation.

Benjamin Fluorescent Lighting Fixtures are warranteed to comply with all recognized illumination, electrical and mechanical standards and applicable RLM standard specifications and to comply fully with specifications and performance data published for each type of unit by Benjamin Electric Mfg. Company. They are fully warranteed against defects in material and workmanship and are built with an extra safety factor of strength to insure long life and maximum durability.

All auxiliary control equipment is certified by Electrical Testing Laboratories to conform with the latest specifications for such equipment sponsored by the Mazda Lamp Manufacturers. Complete units and all auxiliary control equipment and sockets are listed by Underwriters' Laboratories as meeting National Electrical Code requirements as evidenced by Underwriters' inspection label affixed to each unit.

MAIL THIS COUPON for Free "Lite-Line" Bulletin Today

BENJAMIN ELECTRIC MFG. CO. Dept. H, Des Plaines, Ill.

Please send me by return mail, without cost or obligation, bulletin which fully describes, illustrates and gives complete lighting data about the Benjamin Fluorescent "Lite-Line" System.

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Form KAZ can be set to go "on" at dusk, "off" at dawn, automatically changing daily, in accordance with sunset and Floodlighting is used more and more in industrial plants to safeguard factory yards, transformer banks, substations, and other vital points. Because a time-switch makes such installations automatic, many contractors are using Sangamo Time-Switches with astronomic dials, as a sales-aid in obtaining this work. The astronomic dial eliminates all necessity of periodic re-setting, therefore provides completely automatic control. You, too, can get your share of this business easier by including a Sangamo Astronomic Dial Time-Switch in your estimate.

SANGAMO ELECTRIC COMPANY SPRINGFIELD

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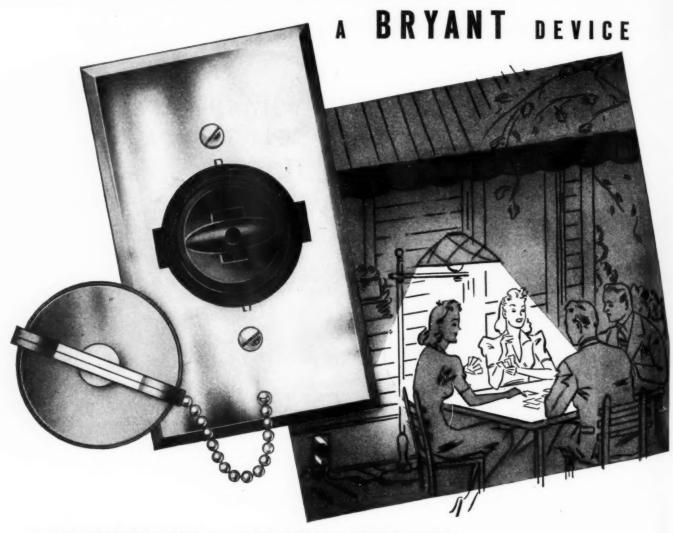
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Electrical Contracting, June 1941

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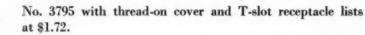
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EVERY OUTLET DESERVES



WEATHERPROOF OUTDOOR OUTLETS

Every adequate wiring installation should include weatherproof outlets for safer outdoor use of electrical conveniences. Here are two of the dependable Bryant types—easy to install and built to serve years longer on your jobs.



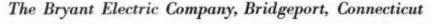


Connection with plug cord can be protected by metal screw cover over cap, No. 3797 at left.



No. 3880 quick-clamp cover with parallel slot receptacle lists at \$1.20.

Consult your Bryant Catalog for all connecting and other wiring devices. If you haven't one, write today for No. 40 with latest pages and prices.



SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

Since 1901 a subsidiary of WESTING HOUSE ELECTRIC & MANUFACTURING COMPANY







"CENTRAL" SHUNTS A LOT OF LOST TIME AND TROUBLE IN ELECTRICAL RACEWAY INSTALLATIONS

NCE you have experienced the ease and satisfaction of installing "Central" Conduit you'll recommend it for life. It's easy to cut and thread and bends properly. Accurate mill threads make tight, well-bonded connections and strong crush-resistant wall and anti-corrosion coating assures the permanence and lasting satisfaction of Central Conduit raceways.

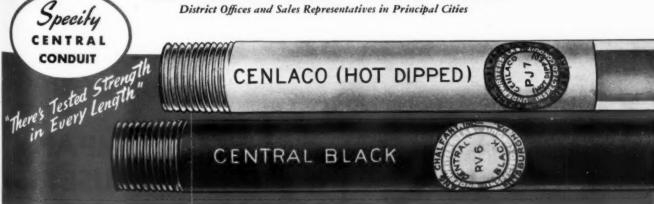
When you consider that Central Conduit installations are faithfully serving such outstanding buildings as New York's Broadway Temple, New York Central

Building, U. S. Marine Hospital at Staten Island, Mellon Institute at Pittsburgh, University of Pittsburgh's Cathedral of Learning and many other imposing structures, there must be a reason.

You'll find prompt acceptance of the name "Central Conduit" on your specification—and your bid can be lower because you are shunting the cost of lost time and trouble in installation. Too, it is easy to obtain. Central Conduit is available through Spang Chalfant distributors in all principal cities.

For Sale By SPANG CHALFANT, INC.

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One of the toughest is the problem of plant shut-downs and delays due to incompetent fuses. You can solve it by installing

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RENEWABLE FUSES

which are backed by the experience of nearly half a century in the field of circuit protection. Shawmut Shur-Lag Renewable Fuses are the simplest, sturdiest and most serviceable time-lag fuses made, and the easiest and speediest to renew.

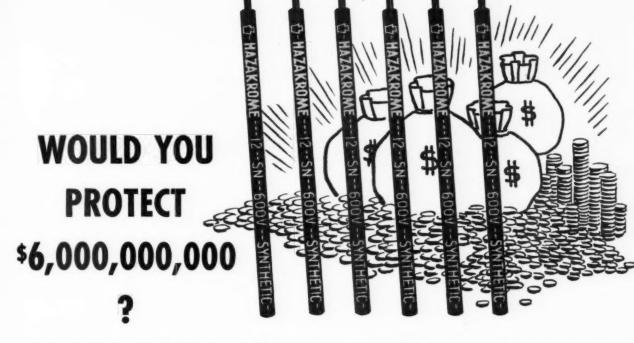
Anything that a time-lag fuse ought to do, a Shur-Lag fuse will do; and will do with a minimum of expense and a maximum of efficiency. If you are having trouble with fuses, specify Shawmut Shur-Lag Renewable Fuses. They end tough problems, as you'll very soon discover. Or for full information, write for our Bulletin 400.





THE CHASE-SHAWMUT COMPANY NEWBURYPORT, MASSACHUSETTS

FUSE MAKERS SINCE 1893



You certainly would if you could. And that's exactly why so many owners of the 6 billion dollars worth of inadequately wired buildings in this country are rapidly taking advantage of Hazakrome Type SN Small Diameter Building Wire.

At last...by rewiring existing raceways with Hazakrome...they can afford to modernize the electrical capacity of their buildings to meet competition.

Alert electrical contractors everywhere are going after this tremendous market that Hazakrome makes so easy to sell. In just one city alone, 23 office buildings have been rewired since this new method was introduced.

And don't overlook this important fact—
there's usually a double profit in every rewiring job you sell! For electrical modernization
includes new service entrance equipment,
branch circuit panels, lighting fixtures, etc.

LET US HELP YOU

To make sure you get your full share of this new business, you should have the Hazakrome Handbook. It gives you all the facts about Hazakrome Type SN Small Diameter Building Wire... tells clearly how to figure installations and capacities... gives you a tested program to sell more rewiring jobs. Send in the coupon below for your copy of the Hazakrome Handbook today!



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Sell Idealfone Systems to Factories • Workshops • Stores

You can offer your customers and prospects either of two types of Idealfones — one-button or five-button — for common talking service from two up to ten stations. Both are BIG values and BIG money-makers!

Fast selling, good looking Idealfones have molded plastic handset, mother-of-pearl push buttons and may be mounted on wall or side of desk. Simple to install, they operate from dry cells or eliminator. Idealfones are for private use only and are not intended to be connected to public telephone lines.

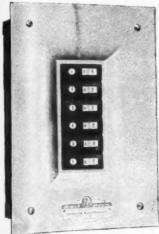
See your electrical wholesaler for further information on these attractively priced, profit-yielding telephones.

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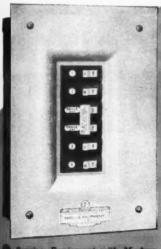
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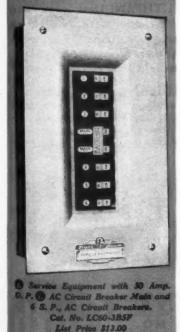
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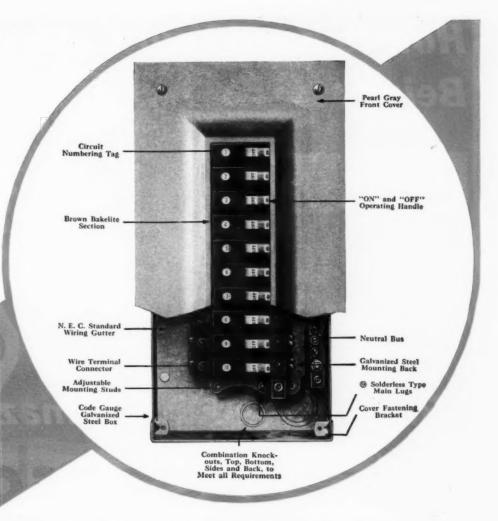


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- · Ample knockouts.
- Plenty of wiring space.

For 120 volt AC Service . . . Capacities: 15, 20, 25, 35, and 50 amperes . . . Approved by Underwriters' Laboratories.

There is a Wholesaler near you

who carries @ Service Equipment in stock, for quick delivery. Write us for his name and address—and for Bulletin 62 . . . Frank Adam Electric Company, St. Louis, Mo.



1941



Cool Light

Cool Air

Recommend This Amazing New

GUIN FLUORESCENT

Combination Lighting and Fan Unit

NOT HOT! Because GUTH Fluorescent Light is a cool light—75% cooler than ordinary light! And because the GUTHFAN circulates, from the floor upward, a scientifically-controlled current of 7° to 10° cooler air which "cools you all over"!

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no drafts—from the GUTHFAN! Desk papers stay put! And there's not the bother of poor lighting, reflections, shadows, or glare, either. Engineered GUTH Fluorescent Lighting, with ALZAK Aluminum Reflectors, provides light right where it's wanted!



Move the Seashore & Mountains into the Office!

Business people know the sound value of working in complete comfort. They want the easy-on-the-eyes light, plus the cool, circulating air, that they can get through the engineered efficiency of this remarkable GUTH Fixture. Recommend GUTH Combination Lighting and Fan Units this summer!

Al Zak, the kid with the extra punch, says: "ALZAK resists abrasion!"



Three lamps in a decorative White Opal Glass Bow top this GUTH FAN to provide a beautiful combination unit for the customer who prefers incandescent

Here is another GUTH Combination Unit which offers modern de sign plus modern efficiency in light ing and cooling White Opal Glass Bowl accommo dates three lamps





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ASERVICE PAPER for electrical contractors, ingineers, motor shops, industrial electricians and inspectors, covering engineering, instalation, repairing, maintenance and management, in the field of electrical construction industrial, commercial, and residential.

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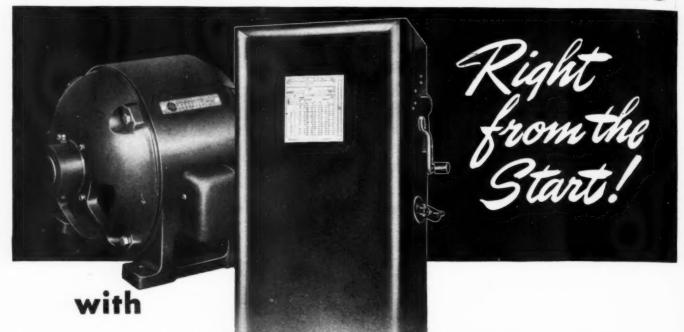
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Gnat Gagging

- GENERAL JEB STUART, THE CONFEDERATE cavalry leader, was a gay blade. He rode his singing horsemen round the Union armies till it gave them the creeps. One night, while loading a wagon train with Yankee stores, he telegraphed the U. S. Quartermaster General. The mules he had just captured, he complained, were of poor quality. They were small.
- JEB STUART HAD A SENSE OF HUMOR. So before the wires were cut, he had some fun with Washington. He also had that other fine trait—a high standard of dis-satisfaction. And he didn't like those mules.
- ELECTRICAL MEN TOO HAVE HAD high dis-satisfaction. Witness our product, our service, our progress. But in the matter of markets we have been more complacent. For example, look at our record in house wiring.
- IN OUR NATIONAL CAMPAIGN last year some 52 local wiring bureaus issued certificates to some 10,000 "adequately wired" new houses. They estimate 170,000 outlets added—many more influenced elsewhere. But let's be realistic. While the hard work of many good men did this, there were 540,000 new houses being built. And 25,000,000 other houses, with families in 'em, stood by needing more outlets.
- WE'VE TURNED OUR BACKS on all these already-built houses. We don't know how to sell 'em more wiring—the old way—house by house. We refuse to face the need to devise some other new way that will work. But it will be done some day!
- WE'LL TACKLE 20 PER CENT the first year, perhaps—say 5,000,000 homes—250 working days—20,000 houses per day—wired for full comfort and capacity. And the fame of this activity will have 5,000,000 more ready for re-wiring the second year. And all this publicity will lift the standard of wiring in new houses automatically.
- ON THE PRESENT BASIS, we're just doing it the hard way—gagging at gnats— when we might be eating good red meat—and plenty. And I'm not just talking mean. This Adequate Wiring Bureau had a broader vision, a bigger plan. But the industry said—"No!" I honor them for starting anyhow. They've done the best they could under the rules. The rules are wrong.
- "YOU CAN'T WIRE 20,000 houses a day!" Who says so? Where's our sense of humor? It just needs specialized Re-wiring Corporations with men, materials, tools and methods standardized for mass production. It can start this year—next year—whenever we wake up.

Swet Shakume

GET THE MOST OUT OF MOTOR SALES



G-E MOTOR CONTROL

...via GraybaR

MANUAL MOTOR-STARTING SWITCHES (CR 1062)



These simple yet long-lived switches contain a dependable thermal overload device for protection against stalled rotor current and injurious load conditions. Toggle switch is flipped up to start, down to stop, and may be locked in "off" position. Types available for ac or dc operation, for motors from 1 to 7½ hp. Write GRAYBAR for Bulletin GEA-1522E giving all details.

MAGNETIC MOTOR STARTER (CR 7006)

Full voltage starter, operated from separate push-button station (or with special push-button in cover). Provides overload and under voltage protection; consists of a magnetic contractor and two hand-reset temperature overload relays. Models available in 5 sizes on every a-c need up to 100 hp. Companion models (CR 7009 Series) give reversing control from 3-button station. Write for bulletin GEA-841K.



COMBINATION MOTOR STARTER (CR 7008)



These convenient self-contained units combine a manual circuit switch and magnetic starter in a single well-protected case. You get extra safety, because fusible cover can't be opened while motor circuit switch is ON. Wiring and mounting is simplified, and the installation is neater. Available in a full-range of types and sizes. Bulletins GEA-2456 shows cost-saving installations in over 25 plants. Write GRAYBAR for a copy.

For increased motor sales...for new highs in customer-satisfaction... be sure your motor installations are given the right kind of starting control. *General Electric* starters are built to get the most out of any motor installation.

In addition to full protection for the motor against injurious overloads, they give extra convenience and security in motor operation. New employees can't go wrong; all live parts are completely enclosed. Contacts and other operating parts have special long-life features. Cases with ample conduit knockouts and terminals help assure speedy installation

When you go to GRAYBAR for these controls, you get other "extras" as well. (1) Frank, competent assistance in choosing the type best suited to the needs of your industrial customers. (2) "One-call" service that brings you motors, controls, wire, conduit and all necessary accessories that will go together on the job.

For motor installations that are "right from the start", put all your needs up to GRAYBAR. Graybar Electric Co., Graybar Building, N. Y.

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WE HAVE NO STRIKES....

Because

The simple story of how organized strikes have been avoided in the electrical construction industry for the past twenty years — An experience that points the way to other industries.

An interview with Louis K. Comstock
by Earl Whitehorne

 Louis K. Comstock, in the electrical construction industry, is an authority on labor problems. He is Chairman of L. K. Comstock and Company, prominent electrical engineering and contracting firm of New York City. He is Chairman of the Council on Industrial Relations for the Electrical Construction Industry. He was for several years president of the Merchants Association of New York and is now Chairman of its Industrial Relations Committee. He was invited to make this statement in the belief that this experience in our field may point the way to a practical solution of the strike problem now besetting the nation.

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Louis K. Comstock

SK the average citizen where most of the strike troubles have occurred during the past twenty years, and he won't hestitate long in answering. "Why in the building trades," he'll say. For in the background of his memory lingers a long series of newspaper stories of strikes and picketing, as steel workers, masons, carpenters, plumbers and painters have quit work in this and that city.

He would be surprised to learn, this average citizen, that one branch of the building trades scarcely ever has been a party to this costly labor turmoil. In the midst of all this dissension between employers and employees, the men who install the electrical conduits and wiring, the switchboards, motors, ventilating fans and lighting fixtures have kept

SK the average citizen where most at work. There have been practically no of the strike troubles have occurred during the past twenty lieve it or not.

I say "practically," not to hedge my statement nor to weaken it; but to clarify it. For there have undoubtedly been isolated cases where the electricians have quit on some individual contractor. The most sensational and notorious instance occurred but recently when the building of the wind tunnel at Wright Field in Dayton was stopped by a walkout of A.F.L. electrical workers, because a half dozen members of a rival C.I.O. union appeared on the job. It outraged public opinion quite properly and was a real shock to the electrical contractors of the country, because such things have been so rare with us.

My statement stands. There have

been no organized strikes in the electrical construction industry since about 1920. I mean cases where a local union ties up the work of the local contractors in the manner too common in other trades.

It all came about most unexpectedly. The story is long forgotten and I think worth the telling. So I had a visit with Louis K. Comstock the other day and got him to go back over the record. For he knows more about the background of labor in this field than anyone else. And we find in this experience a principle or two that should have guiding value to the American people in their present pressing problem of how to restrain the costly, tragic strikes that have been delaying our national defense program.

Council would be glad to undertake it."

And that was the beginning of the end of strikes in the electrical construction industry. Though, of course, much preliminary underbrush had to be cleared away before the Council could qualify as a national agency of arbitra-

Now, the Conference Club was an informal organization of the larger engineering firms of the country engaged in electrical construction. They took work in various cities about the country and therefore had many problems in common. The representatives of these companies met from time to time at convenient hotels to talk things

"As each of us was constantly deal-

out wanting to do something about it. So based on our findings we developed a 'Declaration of Principles' for the guidance of both employer and employee. And this declaration was submitted to the executive committee of the National Electrical Contractors Association with the request that it be approved for submission to their coming convention. This was in 1919."

To show how difficult it has been to get men to even consider the fundamentals of labor discord, the NECA Executive Committee argued over the declaration a whole day. But the principles themselves were not in dispute. It was just reluctance to talk purposefully about labor problems at all. These men were practical contractors. The labor issue was important to them. But they were afraid of it. The declaration was finally approved and endorsed by the membership in convention at Milwaukee in July, 1919 and the Council was made advisory to NECA. These principles were also adopted by the IBEW at their September 1919 Convention in New Orleans.

"In the course of this research," Comstock continued, "the thought had been bearing in on me, that the main trouble was the preponderant influence of personalities over principles. Strikes were called, because men lost their tempers more than because something was seriously wrong in the relationship between the local wiremen and the contractors they worked for. Work was stopped and workers' families suffered and contractors couldn't do business because negotiators from local unions and employers' associations got mad. Threats were made and bluffs were called without the arguments ever being put on paper, without the principle involved ever being analyzed.

"All this we had discussed at length in the Council. So when the suggestion came that the Council arbitrate the Detroit strike, we welcomed the experiment as an opportunity to test out some of our theories. The Council, therefore, agreed to act, but laid down some conditions. We decided to make the proceedings very formal and impressive, in order, in as far as possible, to take on the dignity and atmosphere of a

"Each party to the controversy was directed to present its case in a written brief. They were invited to appear before the Council on the day appointed with their credentials and their briefs. Testimony was to be restricted to the briefs. Both sides were required to exchange briefs in advance of the hearing. "All this ceremony was warmly

BASIC PRINCIPLES

This declaration of principles was developed by the Council and formally endorsed and adopted by both the National Electrical Contractors Association and the Union

- 1 The facilities of the electrical industry for service to the public will be developed and enhanced by recognition that the overlapping of the functions of the various groups in the industry is wasteful
- 2 Close contact and a mutually sympathetic interest between employee and employer will develop a better working system and will tend constantly to stimulate production while improving the relationship between employer and the community.
- 3 Strikes and lock-outs are detrimental to the interests alike of employee and employer and the public and should be avoided.
- 4 Agreements or understandings which are designed to obstruct directly or indirectly-the free development of trade, or to secure to special groups special privileges and advantages are subversive

of the public interest and cancel the doctrine of equality of rights and opportunity, and should be

- 5 The public interest is conserved, hazard to life and property is reduced, and standards of work are improved by fixing an adequate minimum of qualifications in knowledge and experience as a requirement precedent to the right of an individual to engage in the electrical construction industry, and by the rigid inspection of electrical work, old and new.
- 6 Public welfare, as well as the interests of the trade demands that electrical work be done by the electrical industry
- 7 Cooperation between employee and employer acquires constructive power, as both employee and employers become more completely organized.
- 8 The right of employees and employers in local groups to establish local wage scales and local working rules is recognized and nothing herein is to be construed as infringing that right

"It happened down in Asheville, North Carolina," Mr. Comstock said. "A group of us were sitting late one evening, before a blazing wood fire in the Grove Park Inn. It was during a meeting of the Conference Club, and the evening meeting had been discussing a particularly troublesome strike in Detroit. Suddenly somebody put the question --

" 'Why couldn't the Council on Industrial Relations act as a court of arbitration and settle this controversy?'

"There was silence for a moment. It was a new idea and everybody was turning it over in his mind. Then somebody else said-

"'Well, why not?"

ing with the various locals of the International Brotherhood of Electrical Workers," Comstock explained, "we used to invite some of the national officials of that body to meet with us occasionally as our guests.

"Out of this contact, a Council on Industrial Relations for the Electrical Construction Industry had been established. It consisted of ten members, five of whom were contractors from various sections of the country and five were superior officers of the IBEW. I had the honor to be its chairman.

"The purpose of the Council was to study the causes of strikes in our field. We were interested in research only. But it is impossible to study the cause "And I answered: 'I believe the of something that is going wrong, withcriticized and opposed. We were not used to the introduction of order in our controversies with labor. But the Council insisted. And the case was presented and the testimony heard and a decision was rendered. It involved largely an issue of wages and the cost of living and our judgment was influenced by the wholesale index of commodity prices. Both sides were committed to accept our decision and they did. And that was the beginning of peace in the electrical construction industry."

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This was 1920, and in the 21 years since then, the Council has handled about 60 cases. The rest have died aborning in the process of preparation. For the composition of a brief is a hard test for a weak case. And the formal atmosphere of a Council sitting is an uncomfortable place for a man to make a monkey of himself. Therefore, the local leaders of both contractors and wiremen cool down when they face the stark reality of making a case to take to court. Then they redouble their efforts to settle their troubles at home and usually they do.

"Of course, we cannot tell," Comstock pointed out, "but from our knowledge of what has been going on in this field, we estimate that over this period at least 250 of these incipient strikes have been cleared up short of the Council. And this does not mean just 250 instances where controversies have arisen in some city and been ironed out. I mean cases where all hope of local concilation had become exhausted and both sides agreed that the next step was arbitration.

"But when they went to work to put their differences on paper and knew that they faced an exchange of briefs, somebody's case was too weak to hazard. The local union officials would not go before their national officers with such a showing. Or the local contractors saw that they were not strong enough in their position to risk the test."

So the mere existence of the Council on Industrial Relations has just about cured the electrical construction industry of the strike habit. And this has been accomplished with a yearly average of only three cases actually brought up for judgment.

"Now as a practical matter of operation, how has this all come about?" Comstock continued. "In my opinion three very simple measures that have been taken are responsible for the result. These are—

"1. The use of a local agreement between the union and the contractors group providing that any controversy will be carried to the Council before a strike is called. This idea has been promoted both by NECA and IBEW and is now in force between employers and employees in perhaps 280 centers.

"2. The further provision that agreements will be continued until revoked with due notice by either party. That means that there is no stated expiration dates to periodically open the doors for renewed argument. Either employees or employers may bring up grievances or recommendations at any time.

"3. The requirement that before a controversy can be brought to the Council for arbitration, the case must be jointly submitted and reduced to a formal brief and these briefs must be exchanged by the two contestants.

if a day for battle had not been set, wage revisions could have been arranged without stopping work.

"But absurd as it may seem, I believe the simple preparation of the briefs has been the most potent factor in our whole experience. For the process of reducing argument to reasoned judgment is pitiless, where the case has been based largely on loud talk.

"You see all strikes spring from the same cause. The men heading the local employer and union groups disagree over some proposal from one side or the other. They argue over it and lose their tempers. They become intolerant and get to bickering. They begin to play tricks and to threaten. And all at once the fat is in the fire. They can't draw

FUNDAMENTAL IDEAS

This statement of fundamental ideas was drawn up by the Cauncil on Industrial Relations twenty years ago, It has stood the test of all revision and stands today.

1- Strikes and lockouts are undesirable from every point of view.

- 2 No dispute can arise between employer and employee which cannot be settled in friendly negotiation by conciliation or by arbitration, provided the parties to the dispute have the will to honestly try one or more of these methods.
- 3.— The industry cannot fail to thrive an cooperation between employer and employee and will surely languish if such cooperation is absent.
- 4 Cooperation resulting in mutual good will is the key to increased production and better craftsmanship.
- 5 The road to the highest efficiency of the individual working unit lies through the field of frank cooperation and fair dealing.

- 6 Local union leadership must be improved
- 7 The mere display of power is the last thing in the world that insures the success of an association, an organization, or an industry.
- 8 Labor unians, and associations dealing with them, must stop thinking so much about organization and think very much more about the essentials of the cause of the working man.
- 9 Labor unions and associations dealing with them must declare their purpose to bring about three things: (a) Good working conditions, (b) Good wages, (c) The highest possible standard of craftsmanship.
- 10 Labor unions and associations dealing with them must plan their campaigns wholly on the basis of the service they are each capable of rendering
- 11 If a labor union or an association is to make itself desirable and indispensable and cherished for all time, the way to do it is to forget itself in the widest possible service of its cause.

"The agreement to arbitrate is important. It is basic. It keeps ever present the fact that there is a preferable alternative to the strike. And this promise to arbitrate as a last resort, restrains both sides from hasty final action.

"The elimination of an expiration date for the agreement needs no argument. How often within our memory the country has been thrown into convulsion because the contract between the coal miners and operators was up for renewal. It set a time for battle, a day for quitting work. Miners lost their wages. The business of the operators was paralyzed. Coal not mined was lost to this generation. The public was victimized. And all without necessity. For

back without losing face. So the worker's family, the employer's earnings and the public interest are all sacrificed and a fight starts. There is only one way to avoid it and that is to get some friend of both sides to decide the matter.

"This we have made automatic in the electrical construction industry. It can be done in any industry, I believe. And it is far better than restrictive legislation, that seems to curb men's rights to organize and the freedom of these organizations to work for the member's benefit. We have no strikes simply because we have made it easier to settle arguments without battle. It is a common sense arrangement that can be set up in any industry or trade."

FIGURING FUTURE LABOR COSTS

EXAMPLE

Kind of work

Total estimated labor hours

By W. T. Stuart

Men from stores, factories, W.P.A. and trade schools are pouring into the ranks of skilled labor. Average efficiency is lower. How can we appraise labor costs in coming months? Some factors for correcting labor unit estimates.

HE national defense program is upsetting the calculations of estimators. Average labor estimates, and consequently labor units, must be adjusted to new conditions. As a concrete example, in a shop normally working a gang of 12 men:

—One man has been called to military service.

—Two men have left to work on army camp jobs.

-One foreman has taken a government job.

—Four men have been taken from the union rolls to fill the gap. Two came from W.P.A., one from a maintenance job, one has filled in among several contractors as an extra man.

—The estimator has on the boards a factory remodel job that will take five men in August and September, and a new hotel that will take from 10 to 20 men starting in August and running into March of 1942.

How can he hook up his labor manual to future conditions? What level of skill may be expected from the kind of men he will be able to hire? These are quesEXAMPLE SHOWING the application of the tables to a typical job schedule. (Slide rule calculation). Labor units are based on 1939 average efficiency.

1300			1300	
100	$+10\% \times 2$		220	
25	+ 25% × 2		63	
640			640	
640	+ 17%		748	
640	+ 22%		780	
3545			3951	
ected for job	schedule			3951
applied to to	otal schedule	d labor	hours.	
			+ men	
	Totals	Factors	efficiency	
465 hrs.	465	+0 %	465	
440 hrs. each	1320	+20%	1584	
361 hrs. each	1083	+ 0%	1083	
361 hrs. each	1083	+50%	1624	
361 hrs. each	1083 3951	+50%	1624 4756	_
	640 640 640 3545 rected for job s applied to to	100 + 10% × 2 25 + 25% × 2 640 + 17% 640 + 22% 3545 rected for job schedule s applied to total schedule Totals 465 hrs. 465 440 hrs. each 1320	100 + 10% × 2 25 + 25% × 2 640 + 17% 640 + 22% 3545 rected for job schedule s applied to total scheduled labor Totals Factors 465 hrs. 465 +0% 440 hrs. each 1320 +20%	100 + 10% × 2 220 25 + 25% × 2 63 640 - 640 + 17% 748 640 + 22% 780 3345 3951 rected for job schedule s applied to total scheduled labor hours. Totals Factors + men efficiency 465 hrs. 465 + 0% 465 440 hrs. each 1320 + 20% 1584

TARLE 2

fficiency Factors for overtime and shift work applied to standard unit labor.

Factor

Unit L. H.

tions that every contractor is asking today as prices are made for work that must be done three months to a year hence.

This we know with reasonable certainty:

1. Our labor hour costs are generally based upon 1939 experience.

2. The bottom of the barrel of skilled labor is now in sight.

3. Electrical work in the latter part of 1941 and into 1942 will require about two and one-half times the number of labor hours that were worked in 1939.

Grading all mechanics on the basis of skill, they may be classified in five groups A, B, C, D and E. Most of the 1939 work was done with the best, the A and B men. Consequently our labor experience or labor units are adjusted to their skill.

Setting our classification against a percentage of average skill gives the values shown in Table I.

The meaning of the percentage to be applied to labor units is familiar to those estimators accustomed to using efficiency factors. If, for instance a job had to be done with all E men it would take twice as long or 200 per cent of the estimated labor hours. So in applying this table to the estimate:

1. Take off, extend and total the labor with conventional labor units.

2. Make a rough progress schedule of the work indicating the number of men required.

3. Schedule the known men that will be available from the regular crew and fill in the schedule with men of lower skill rating.

4. Average the percentage ratings of the crew from the figures in the table.

5. Apply the average factor derived to the labor hours total as shown in Table 2.

In setting up the man schedule, it is important to make a fair appraisal and not a hopeful guess. With the vast increase in construction work incident to defense expansion, good mechanics are already hard to get and harder to keep. While it is quite possible to figure and handle a single job with a full crew of A and B men, careful management will schedule the better men over all of the work in key posts. No competent figures can be developed for handling skilled work, if the full crew must be drawn from men of unknown and uncertain ability.

Then an increase in overtime and shift work introduces another set of costs that must be considered in the labor column.

Overtime falls into two classifications under present conditions.

1. Overtime consisting of an hour or two extension of the regular day.

Overtime extending into the night or over weekends.

The lag in man efficiency is slight in the first instance and, if the extension (Continued on page 83)

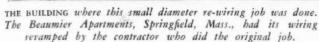
TABLE 1

LABOR HOUR EFFICIENCY FACTORS

Man efficiency	
A-15% of men	.90 $ imes$ avg. unit
8-25% of men	1.00 imes avg. unit
C-20% of men	1.20 × avg. unit
D-20% of men	1.50 imes avg. unit
E-20% of men	2.00 imes avg. unit
Overtime	
2 hours a day or less	1,10 × avg. unit
Extended overtime	1.25 imes avg. unit
Shift work	
4 P.M. to 12 M.	$1.17 \times avg.$ unit
12 M. to 8 A.M.	1.22 imes avg. unit

FACTORS TO apply in correcting tabor estimates to present conditions of labor and job operation.







THEY DID THE WORK-Here left to right are: J. M. Turnbull; J. M. Grogan, Contractor; and his men Frank Frieze and Bill Shaylor; also W. C. Field, Wiring Inspector; and Joe Broska.

Small Diameter Wire in Range Rewiring

How Grogan Electric Company pulled new capacity into an old apartment block to serve modern electric ranges.

By J. M. Turnbull

Service Engineer, United Electric Light Co. Springfield, Mass.

N 11 year old apartment house that was one of the first allelectric buildings in Springfield, Mass., was recently rewired with synthetic-insulated conductors to serve new larger-capacity ranges. The early 5.5 kw. ranges were replaced by 10.3 kw. units. The diagram illustrates how inadequate those original circuits were for this additional load.

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With the cooperation of the local Wiring Inspector, the United Electric Light Company of Springfield planned the rewiring job. It was carried through by the Grogan Electric Co. of Springfield. Local jobber, Charles E. Hayes Co., supplied the material. Incidentally, Jack Grogan installed the original wiring.

The building was provided with a 1½in. vertical raceway from the basement meterboard to the first floor cutout panel, reducing finally to 3-inch diameter from the third to the fourth floors. The toughest job was apparently going to be the installing of 12 No. 6 wires around the elbow at the basement ceiling. But the No. 6 sixstrand type SN conductors went in easily. The Grogan Electric crew were pleasantly surprised. Credit is due them, however, for forethought.

For one thing, they had the syntheticinsulated conductors warmed up in the boiler room, just before they pushed these 12 wires from the first floor to the basement meterboard, with the help of a pulling rope to the meterboard. SN is easy to work as long as it is warm, they say. As for the other nine-, six- and three-wire installations they simply pushed them up into the pipes. Then, too, the old pipes had been swabbed clean of any sticking braid from the covering of the old wires.

The No. 6 SN skinned readily by simply cutting one side and peeling. As to terminals, it is worthy of note

that solder was not used throughout the entire work, which is characteristic of Jack Grogan's clean, fast, workmanlike jobs. Another interesting detail is that no bother was experienced pulling three No. 6 SN wires through the bends of the 3-inch flexible conduit connections between the individual meter switches and the ceiling pull box over the meterboard.

The run from the fuse panel to the surface receptacle was made with S.E. cable type A, the metal tape providing the grounding means. Conduit, armored cable and metal molding were considered, but rejected because their shape would have been more difficult to blend into the wall surface. The partitions could not be fished because of insulation therein. Furthermore, the owner was opposed to cutting and channeling of walls.

In each apartment the flush box,

 $7\frac{1}{2}$ -in. by 8-in. by 3-in. deep, which had housed the 4-30 amp. cutouts, was used as a pull box to feed the attached surface panels. Here they provided the main disconnect for the apartment, plus range switch and branch circuit fuses. On the service end, no change was needed up to the main gutters. The 400- ampere entrance switch with two 350,000 cm. feeders and a No. 4/0 neutral gave ample capacity for this 25-range installation.

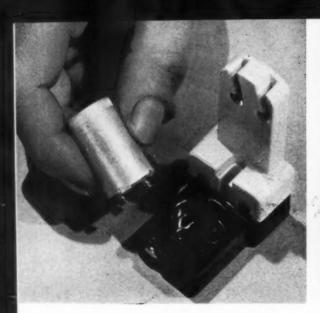
2nd floor 9 No.6 SN RISER CIRCUITS of synthetic insulated small diameter wire feed the cutout panel in each apartment. Existing incoming service to meter board was of sufficient capacity. in 11/4"c. 1st floor

Typical Riser Diagram

Electrical Contracting, June 1941

3 No. 6 SN 3rd floor 6 No.65N 12 No.65N in 11/2" c.

Two lighting circuits



STARTER AND LAMPHOLDER for fluorescent lamp with attached socket and plug-in starter.



MOVING OBJECTS need two lamp ballasts and twin lamp ballasts so that all annoyance from stroboscopic wavering is prevented.

E are in possession of a new lighting tool. It consists, in its simplest form, of a fluorescent lamp, a pair of sockets, one containing the receptacle for the starter can, and also a ballast unit for mounting in a wiring channel. What is the practical procedure to be followed by the contractor?

First observe the label on the ballast unit. Note if it be designated as "high power factor" type. If not, do not install it unless sure that the customer thoroughly understands the penalties incurred by using a low or bad power factor device. In the latter is only a series or auto-transformer, which causes the current to lag behind the voltage, with a power factor of about 60 per cent. In the high power factor ballasts is also a condenser, bringing the alternating current back nearly in phase with the voltage, that is to at least 90 per cent power factor.

Next note the "line current." This should be given on the label and will determine the number of fluorescent lamp units that may be connected on a branch circuit. For example, with the single 15 watt lamp this figure will

Installing the Fluorescent Job

How to be sure you are right in installing fluorescent mazda equipment. Second in a series of articles by this leading authority to help the electrical contractor in "Getting acquainted with fluorescent lamps" combining data and installation experience.

By S. G. Hibben

Director of Applied Lighting, Westinghouse Lamp Division, Bloomfield, N. J.

be about .18 amperes. See Table I. So theoretically if we decide to load a branch circuit to 15 amperes we could connect up to 83 of the 15 watt lamps. The two-lamp ballasts slightly reduce the loading of the circuit.

Note, however, that at the instant of starting, each lamp may momentarily draw up to double the operating current. And while all lamps of a circuit may not start simultaneously, and while this starting load may not normally persist long enough to blow a fuse, yet it is well to allow some margin of safety. Do not load a fluorescent branch circuit to theoretical capacity.

Mounting the Ballast

Next in order will be the mounting of the ballast unit. This is designed for bolting to the raceway or to any suitable background. It is a simple matter, if this background is not a sounding board and the hum is not objectionable. Otherwise install vibration absorbing washers or a pad beneath the unit but taking care not to tightly wrap the ballast, as that may cause it to overheat. Use lock nuts or lock washers. Avoid loose fixture parts. Expect a slight magnetic hum, but it should not be audible beyond a yard

Do not pile up several ballasts touching each other. Under burned-out lamp conditions, the ballast should not exceed about 190° F., so keep them well ventilated. Rubber-covered wire must not lay in contact with ballasts.

The pigtail leads from the ballast will reach to each lamp socket, if this unit is set approximately midway between. If the ballasts must be farther away from the sockets, as in showcases, always use soldered extensions on the pigtails, of high quality insulation.

TABLE

Use of High Power Factor 60 Cycle Ballast Units, On 118 Volts

Lar	mps			Line Amps.		No. Lamps Circuit on		
Two	15	W	T-8	.35	9	Max.	of	86
Two :	20	W	T-12	.43	9	11	85	70
Two :				.66	14.5	99	.09	46
Two	40	W	T-12	. 86	17.5	99	81	34
Two I	00	W	T-17	2.05	35.0	99	89	14
One	15	W	T-8	.18	4.5	Max.	of	83
One	20	W	T-12	. 23	4.5	0.0	00	65
One				.37	10.0	**	89	40
			T-12	.50	13.0	09	81	30

Keep their length to a minimum. Several yards of wire is permissible between ballasts and sockets but the longer, the more likelihood of radio interference trouble.

Built into the FS starter is a small condenser to suppress radio interference at the time of starting. But while a lamp is normally operating, there can be radio interference (a) from the arc stream of the lamp itself, (b) from the extra long leads between ballasts and sockets and (c) from a feed-back into the branch circuit wiring. Good radios, of course, will have static suppressors or noise-eliminator filters built into them to take care of any feed-back over the branch circuits. But, in general, no fluorescent lamp wiring should be closer than perhaps three feet from a radio set.

On the face of the ballast unit appears a wiring diagram and the connections are simple. However, note one precaution. The two-lamp ballasts. capable of operating two fluorescent lamps from the same unit, are designed to deliver a leading current to one lamp (usually the red pigtail) and a lagging current to the second (the blue pigtail). A starting compensator, which is a small reactor, should be connected in series with the starter switch of the lead current lamp. At present this applies only to the 30 and 40 watt lamps. The aim is to increase the heating speed of the lamp electrodes and reduce the cold starting shock. The life of the lead current lamp would be greatly reduced if this compensator were not used. Be sure that the compensator is connected to the right lamp.

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Of next importance is the mounting of the sockets. These should be firmly bolted to the reflector or to a fixed backing. And keep always in mind that the nominal overall lamp length determines the overall outside-to-outside spacing dimension of the sockets. And the outside back-to-back spacing should not be greater or less than—

LAMP SIZE	MAXIMUM SPACING	LIMIT
15 Watt	18-1/32	
20 Watt	24-1/32	
30 Watt	36-1/32	
40 Watt	48-1/32	
100 Watt	60-1/16	
LAMP SIZE	MAXIMUM SPACING	LIMIT
15 Watt	17-31/32	
20 Watt	23-31/32	
30 Watt	35-31/32	
40 Watt	47-31/32	
100 Watt	59-15/16	

Average thickness of each medium bi-pin socket is $\frac{3}{8}$ inch; of each mogul bi-pin socket $\frac{13}{8}$ inch.

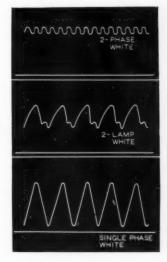
The FS starter can is inserted in its receptacle by a twisting motion, on the base of one of the sockets. Then the fluorescent lamp can be inserted. But keep the hands away from live socket parts or better replace lamps only with the current turned off.

If a good lamp "flicks" on and off, the break-down resistance of the glow relay starter may be too low, so that it repeats its arcing cycle. If the ends of the lamp bulb quickly blacken, check the rating of the ballast unit and the applied voltage.

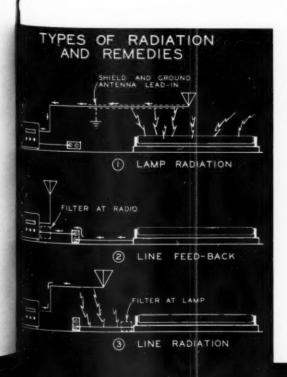
In choosing the branch circuit wire size note that bad power factor ballasts will require approximately double the current carrying capacity of the branch circuit for a given number of lamps. Or only half as many lamps can be connected as on a branch circuit when using high power factor ballasts. The overall power factor of a lamp and a good ballast will be 90 to 95 per cent. So even under the best circumstances, it is not wise to load the branch circuit to its theoretical wattage capacity.

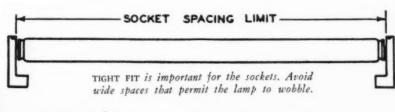
In fact, since low voltage at the fluorescent sockets tends to reduce lamp life, more than ordinary care should be exercised in providing ample copper. On new installations, it is good practice to use as big a wire size as though a filament lamp load were expected. Certainly you should provide a greater

[Continued on page III]



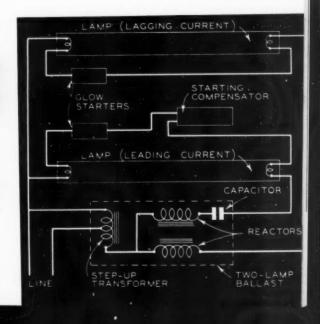
CANDLEPOWER VARIATIONS in fluorescent lamps used in alternating current. On the lower curve the distance between peaks represents 1/120th of a second.







TWO LAMP BALLAST for use with fluorescent mazdas and wiring connections for connecting up a two lamp ballast installation.





"WE'VE GOT TO MAINTAIN our working capital. No more notes receivable—and put more pressure on collections," warns the boss. able-and put more pressure on

ET profits, sales and net worth are the Big Apples of the electrical contractor's eye. Seldom does he consider working capital, yet, it is equally important. Recently, we closed the books for-well, let's call them "Ryan and Harper," electrical contractors. They were unfortunately forced into receivership. The case is real, but for professional reasons, we cannot reveal the firm's right name.

Great surprise was manifested when Ryan and Harper went ga-ga financially. From the outside looking in, they seemed to be prospering. Sales had increased each year and were budgeted for \$200,000 in 1940 when the blitzkrieg struck. The net worth was \$21,799.72. And this was substantial for a firm in business only six years, where the partners were drawing sizable salaries. Annual net profits ran from 3.7 to 7.1 per cent on sales with no red ink finales. But, the sheriff said, "Howdy!"

Why was it? The accompanying balance sheet tells the story. Ryan and Harper simply lacked working capital. This means the excess of current assets over current liabilities. It is the source of funds to meet current obligations: taxes, payroll, interest, bills payable for materials, and the rest of the current demands.

Safe Ratios

Working capital consists of two parts: (1) cash assets, comprising cash and receivables, and (2) trading assets or inventories. When cash assets equal

current liabilities, your financial condition may be considered satisfactory. So it is well to approximate this ratio at all times. But if cash and receivables exceed the cost value of inventor'es then the working capital may be lower than if inventories exceed cash and receivables. This is because there is more confidence in the liquidity of cash assets than in inventories. For inventories are subject to market fluctuations and customer acceptance, whereas, cash and receivables are definite sums.

No fixed ratio is recommended between cash and the other accounts but it is generally expected that the bank balance will run from 20 to 25 per cent of current loans. For this contingency alone, Ryan and Harper should have had about \$2,100 in the bank. Their balance sheet, however, showed only \$407.66 in bank and on hand.

Working capital may fluctuate with seasonal demands and provision must be made to meet them. It should be high, for example, before heavy seasonal purchases, also, to meet likely increases in variable expenses, such as when advertising, payroll and incoming freight drains will be heavy. Selling efficiency, credit and collection procedure will also affect working capital. And so we find that where business management is efficient, the working capital is usually in better condition than where the reverse is true. And where credit is granted promiscuously and collection procedure is below par, working capital will be unsatisfactory.

The capable contractor keeps sales

Your

By Arthur Roberts

moving so that cash keeps streaming into the till in a consistent flow. Adequate credit and collection procedure also keeps receivables paying up promptly. Here notice that Ryan and Harper carried \$5,972.40 in notes receivable or more than half the accounts receivable. Analysis showed that they had been taking notes in lieu of payments in cash on accounts receivables. But such bad collection practice, ties up working capital and invites the sheriff.

Meet Conditions

After stocking up heavily for a busy season, of course, the cash may be relatively low. But this will be temporary with good management, because the current assets will be converted into working capital fast enough to meet all obligations promptly. If sales and collections are handled efficiently, there is no risk here.

Certain authorities contend that working capital should be twice the current obligations. The electrical contractor need not accept this as a hard and fast rule. The ratio will fluctuate with credit terms on receivables, paying methods of customers, the number of slow pays on the books, the season of the year, the adequacy of inventory to current demands, the inter-relationship of cash to receivables and inventory. If receivables pay promptly and inventory turns satisfactorily, the business will need less working capital than if the reverse condition were true. If inventory is adequate for current demands, current purchases will be low, necessitating less working capital than if large purchases must be made soon to stock up on supplies or equipment. Such factors vary with the business and must be considered when appraising the adequacy of working capital. When the current liabilities exceed the current assets, there is a floating debt. Ryan and Harper were mighty near the line.

They had a working capital of \$759.72, the difference between \$21,-

How to use this sharp tool of management—Illustrated by the experience of Ryan and Harper on whom the Sheriff called.

474.40 in current assets and \$20,714.68 in current liabilities. If inventories and receivables were of quick liquidity, their working capital should have been around \$20,000, with more than \$2,100 in cash always on hand until the notes payable were cleaned up. This would give what is called a "current ratio" of about two to one, two that is in current assets to one in current liabilities. Bankers and credit men consider that the electrical contractor's business is financially sound if it approximates this current ratio.

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3 LINE RADIATION

Ryan and Harper had set aside no reserves for depreciation, however, and the books showed that about \$5,000 should have been so segregated for depreciation and other contingencies. But the size of a surplus or net worth is often a misleading yardstick with which to measure financial stability. Working capital is usually a pretty good gauge of business success. Like gas te a car, a business cannot run without it, but in more than half the electrical contracting establishments it is below par, if not all the time, a large part of the time. Like Ryan and Harper, many of these organizations appear robust. But inattention to working capital requirements prevents them from making the most of their capabilities.

Watch Over-Investing

Ryan and Harper made substantial profits in past years but misused them. Instead of maintaining a safe margin on working capital, they disregarded it entirely. They bought too heavily on credit and when they couldn't pay their bills, borrowed from banks and others. They took contracts at prices below cost plus profit and extended credit too freely. They bought their business property for \$30,000, added \$2,840 in improvements, and paid off only \$12,840 in three years, leaving a mortgage of \$20,000 outstanding. They drew larger salaries than circumstances warranted. They invested \$2,500 in securities to be used as collateral for

474.40 in current assets and \$20,714.68 loans, freezing their working capital in over-expenditures for fixed assets and personal withdrawals, instead of maintaining a safe margin for current obligations.

But management must be careful about over-investing in fixed assets or slow-moving stock. It impairs working capital. Also, it means fixed charges for taxes and upkeep, which is a drain on working capital.

Must Be Managed

The successful electrical contractor knows how to make money and what to do with it afterward. Ryan and Harper could make money but couldn't manage it. So they went with the wind. On the surface, they seemed to be prospering but each month brought them nearer to insolvency as creditors pressed harder, as upkeep or fixed assets mounted, as inefficient collection procedure and unprofitable estimating made the maintenance of adequate working capital impossible.

When you analyze business operations periodically, as all contractors and motor shop men should do, give thought to working capital as well as to sales, profits and net worth. Compare the ratio of working capital from month to month, just as you do the trends of sales and profits. For this provides a yardstick to gauge the desirable working capital ratios from season to season. But ratios, like all accounting data, of course, should aid in the formation of judgments, not be used as a substitute for judgment. The electrical contractor must judge, in the light of all relevant circumstances, whether his working capital ratio is financially safe and economical, and at the same time also adequate to all other factors and demands of the business.

An important consideration is whether a business can meet its liabilities at maturity. It is well, therefore, always to try to keep enough cash on hand to meet all bills for at least 60 days. And the maintenance of adequate working capital, clearly indicates that a prospec-

tive borrower is not over-capitalized on fixed assets or has not suffered recent operating losses. These are the two main factors that drain working capital.

Banks and credit men consider a risk favorable when working capital is adequate. Yet excessive working capital may indicate unprogressiveness. For a contractor may be too satisfied with ample working funds, and to protect it operate with obsolete working equipment, old tools, old trucks, old fixtures, old methods. In fact many old reliable concerns have closed their doors with ample working capital, paid off creditors and had funds left after auctioning off the working assets. But they failed through lack of modern business methods and equipment, not through lack of working capital.

So check your working capital periodically. Make sure that it does as good a job for you as you do for your customers or as your journeymen do for you.

RYAN AND HARPER STORY

Balance sheet or financial statement as of March 1940 when the receiver was appointed.

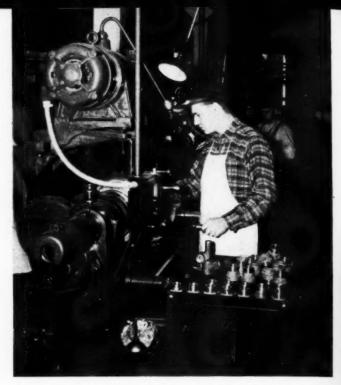
ASSETS

ASSETS		
Cash in First National Bank	\$381.76	
Petty cash fund	25.90	
Accounts receivable	10,812.64	
Notes receivable	5,972.40	
Inventories of materials, supplies and		
electrical equipment	4,281,70	
Total current assets		\$21 474 40
Total Current assers		421,414,40
Land for business purposes	15,000.00	
Buildings for business purposes	17,840.00	
Shop equipment, tools, bins and fixtures	2,500.00	
Trucks (2)	2,000.00	
Office furniture and equipment	1,000.00	
Total fixed assets		38,340.00
Other assets		
Insurance deferred	200.00	
Investments in securities	2,500.00	
Total of other assets		2,700.00
Total of all assets		\$62,514.40
LIABILITIES		

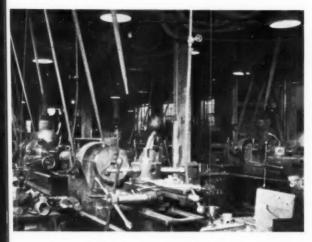
Accrued liabilities, including wages, taxes and interest	
Total current liabilities	
Total current and fixed liabilities	
Total liabilities and net worth	\$62 514 40

Modernizing a Machine Shop

When this brass foundry had to enlarge and relocate its machine shop, the old line shaft and flapping belts gave way to a modern bus duct distribution system and an individual motorized drive for each machine.



UNIVERSAL DRIVE transforms former belt driven machines into individual motorized units. Magnetic starter and reversing switch on machine provides finger-tip control to the operator.



BEFORE THE CHANGE, line shafts, counter shafts and a maze of belts cluttered up the ceiling, obscuring light and creating an unpleasant working atmosphere.



AFTER THE CHANGE. Flexible distribution, straight-line machine arrangement, plenty of natural light and aisle room, and pleasant surroundings combine for efficient production.

HEN increased business required the expansion of the machine shop of the A. W. Wheaton Brass Works in Newark, N. J., the company built a 5,800 sq. ft. addition and relocated the shop in this new wing. Natural illumination is provided by windows on three sides.

The company also decided to install individual motor drives for all machines. These were previously belt-connected to an overhead lineshaft driven by a single 25-hp. motor. The transition was made by purchasing 15 new motors, ranging in size from \(\frac{3}{4}\)-to 5-hp. A majority of these new motors were furnished complete with a Lima three-speed, universal transmission drive, adaptable to almost any machine.

To serve this revised machine layout, the E. J. White Company of Newark, electrical contractors on the job, suggested a bus duct distribution system. Accordingly, 140 feet of 250-ampere, 600 volt Flex-A-Power was installed. One line ran down each side of the shop, with an interconnecting line between. Two-phase, three-wire, 220 volt power is fed from the duct lines to the individual machines through 31 swingout type fused Flex-A-Plugs. Each machine is equipped with a magnetic starter and a lever type forward-stopreverse switch, providing complete control within the operator's reach.

The advantages of this modernization program, as outlined by the plant management are:

- 1. Better Working Conditions—More light is available and light colored ceilings can be easily maintained because there are no overhead lineshafts and belts. The elimination of these shafts also reduces vibration and the noise of flapping belts, another aid to employee comfort.
- **2.** Maintenance Economy The inherent high cost of maintaining shaft alignment, bearing replacements and belt repairs is eliminated
- **3.** Increased Production—Individual motor drives eliminates costly production interruptions caused by shaft and belt breakdowns when all machines driven by the shaft must be idle. Finger-tip control at the operator's side saves time.
- **4.** Power Economy—Previously the large main drive motor had to be used if only one motor or two machines was necessary for rush jobs. Individual motor drives eliminates this as well as the power lost through line shaft transmission.
- **5.**Reduced Hazards—Elimination of the overhead belt drives reduces the hazard of injury to machine operators.
- **6.** Increased Efficiency—The combination of the above advantages results in a general increase in the overall plant efficiency.
- 7. Flexibility—The combination of individual motor drives, plus the bus duct distribution, provide flexibility for machinery arrangement and future expansion. This system also has a high salvage value.

What happened to this machine shop is typical of what engineered modernization can do for hundreds of average sized shops throughout the country. Changes like these are the backbone of production efficiency and should be kept in mind by the plant management and electrical contractor. For the Defense Program demands flexible production.

MOW...a new low-priced

CUTLER-HAMMER

230 VOLT

INDUSTRIAL MULTI-BREAKER





A Cutler-Hammer Industrial Multi-Breaker at little more than the price of a type A Switch.

No more bother of replacing fuses.

Visible Trip Indicator tells you at a glance when an overload trips out the breaker. e Cutter-Hammer announces a new 230-volt industrial Multi-Breaker... at little more than the price of a type A switch. It affords exceptionally economical application as a motor circuit switch or service disconnect switch. This new breaker is fuseless, with bi-metallic strip actuation, visible trip indication and a trip-free lever. It is quick make and quick break. Its rated capacity is 230 voits from 15 to 100 amperes and it is available in 3-pole, or 3-pole solid neutral or 4-pole solid neutral types. Calibration is set at the factory and cannot be tampered with. The breaker is completely enclosed and semi-dust-tight. Front access and operation makes this breaker convenient and compact and economical of space.

in design, manufacture and operation, this new industrial Multi-Breaker is outstanding. It is available through all Cutter-Hammer wholesalers. Further information will be sent you on request. Write today. CUTLER-HAMMER, Inc., Pioneer Electrical Manufacturers, 1306 St. Paul Avenue, Milwaukee, Wisconsin.

Front-Operated for easy access. Economical of space, yet extra room for wiring.

No Tampering. Calibration is permanent, fixed at factory.

Safety Operation. Completely enclosed, semi-dust-tight.

BULLETIN 4252

CUTLER-HAMMER

MOTOR CONTROL

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G-E MAGNETIC Save Costly

is the RIGHT CONTROL for these jobs



Controlling a 3-hp splashproof motor that drives a bottle washer in a Cleveland dairy.



Controlling the small motor driving the conveyor on a senforizing mechine.

You Wouldn't Install a Boiler without a Safety Valve!

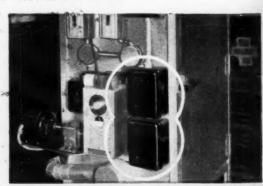
But a motor installed without adequate overload protection can be just as much a menace to production—

ALL too frequently, a motor is installed with only a switch to start it and stop it. In case of overload, it heats—and heats—until a winding or a bearing suffers.

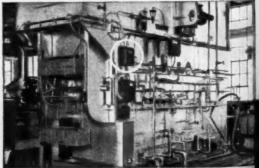
The inevitable result is a shutdown that holds up production, requires a costly repair job, and wins ill-will for the contractor. Install correct control for the motors you install—with adequate overload protection. It's good insurance.



OVERLOAD PROTECTION



These magnetic switches—actuated by time switches—control heating elements for a baking oven.



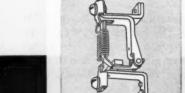
Amidst a maze of piping, this starter controls the conveyor drive for a large degreaser.



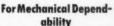
CORTIFY yourself against costly call backs due to starter trouble or motor burnout by installing the right G-E control. Note the three features (at right) that are your assurance of freedom from trouble after you've completed a job. Incidentally, this is a control that you'll be able to use in a good many different places. A few of the hundreds of uses are shown at the left.

And there's no better way to assure satisfaction than to install control that eliminates "call backs." Leading contractors the country over make sure of the jobs they install by ordering all their control from convenient General Electric distributors.

General Electric Company, Schenectady, N. Y.



For Electrical Safety
A heavy-molded arc
barrier of long-fibered
asbestos separates the
poles—to confine arcing due to opening under load and to increase
electrical safety.



A sturdy lift-type solenoid magnet operates the starter. Notice copper "pole-shader" on end of plunger which smoothes out the pull for quiet operation.



continues long enough to overheat motor, bimetal strip is deflected and opens starter.

GENERAL & ELECTRIC



Earl Whitehorne, Editor

Priorities

Priorities is a war word in American business. It is again in common use. But just what does it mean today to the electrical contractor, the industrial plant electrical staff and to the motor shop? So far in this emer-

gency it means just this.

Washington has drawn up a "Critical List" of materials that are important to defense production. Some of them, like machine tools are already being reserved for use on Army, Navy and British orders. Any of them may be restricted at any time-motors and generators, for example, copper and aluminum. Your orders will be delayed, defense needs having the preference.

Your only protection then lies in the priority status of your customer. If you need the wire or the motors for a factory making shells, the necessary form citing that fact must go with your order. That will secure it the preferential treatment it deserves.

So far few rigid priorities have been established on materials important to electrical men. But as deliveries get slower with increasing war production, it will happen. It has become necessary, therefore, that you work closer with your customers. Know the war status of their work. Build up the priority status of your orders on their needs.

Fewer Wire Sizes

No one can question the need for reducing the present building wire line. At present, there are 64 varieties of every size of rubber covered wire from No. 14 to 2,000,000 cmin all, 1664 different wires. It is the worst kind of waste and not to be suffered longer in these war times.

NECA was wise therefore in taking the initiative in seeking to place all sizes over 500,000 circular mills on the special order basis by its conference before the Bureau of Simplified Practice in Washington. And it is asking the Electrical Committee N.F.P.A. at its meeting this month to eliminate Types R, RP, RPT, RH and RHT in favor of one new type R and to make the necessary changes in the code.

Some men will complain over changing the new code so soon in this already complicated wire section. But the answer is that this will simplify the situation. It will also conserve copper by reducing stocks at a time when copper is vital to the needs of war. And that's reason enough.

Sub-Standard **Defense Wiring**

Some defense housing projects are being wired with a pair of No. 10 for service. There are two circuits-one for lights, one for outlets-pull chain fixtures in halls, bedrooms and even kitchen, no switches except one for the bathroom, a couple of convenience outlets for the living room and no center fixture. The kitchen has one outlet for the refrigerator and that

But the whole job is not that cheap. There is a rather high standard of building construction-weather stripping, copper plumbing, insulation, often steel casements and concrete or tile walls. The wiring is almost the only facility that is so conspicuously below par.

After the emergency these houses

are to be sold or rented to civilian population. Not if the women living in them remember how hard it is to use an electrical appliance. Before more are built, somebody better let out a holler loud enough to be heard.

Why Ten Bidders?

Estimating is a complicated engineering job. When ten or fifteen contractors are asked to submit prices, that means as many engineers devoting valuable time to a job that should be done by one, two or three.

It is impossible for contractors to control this waste. A central reporting agency or bid depository would be subject to federal prosecution. Yet it is a serious question whether on most projects more than three bids are needed to provide all the advantages of free competition.

Much could be saved by a preliminary "qualification bid" listing organization, experience and equipment available for the job. The final bidders could be chosen from those best quali-

Turn Out the Dark

The frugal habit of turning out all lights when the family retires is neither real economy nor good sense. The cost of a broken limb that a little light might prevent would keep the home in a blaze of light for a lifetime.

Low level night lighting deserves more attention from builders, electrical contractors and utilities. At present power rates and with low consumption fluorescent lamps cost is no obstacle. The problem is to tell the story and do the selling. It is easy to provide specific night lighting, independent of other lighting sources, adequate to safely cover the usual nocturnal trails.

Better Than Competition

As Walter Collins puts it, most contractors are trying to find nice, clean brick piles where they can match wits with 10 to 15 competitors. They are forgetting all about a possible rewiring job that awaits them throughout the city that somebody is going to make a fortune on.

This has never been so true as right now with war and preparedness in the air. Don't wait until a factory

starts to make munitions in your town, for every industrial plant will be affected whether they make munitions or not. They will be beset by labor shortages, by higher taxes and a dozen other influences that call for new economies in production. You have the answers to many of them.

Sales Appeal Works

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Sometimes in our sales work, we get all tangled up in the jargon of electrical contracting. We forget that the customer knows little about wiring and cares less.

A Minnesota contractor recently tackled a customer with a long list of suggestions. He came out without an additional outlet or run of larger wire. But he had sold a kitchen exhaust ventilator and silent mercury switches throughout, in a very modest home.

It is worth noting that neither of these items can be classified as essentials. But each has a distinct and specific sales appeal.

For Better Business

Around Detroit there is some talk of cooperative wiring corporations to handle the boom in residential wiring. Several independent small contractors may band together under a common corporation, pooling resources, buying power, credit, tools and ability. This is the most hopeful and common sense plan to pop up in many years. We hope it goes beyond the talking stage.

Our Unmentionables

Architects' house sketches always omit the three large black lines running from under the eaves to a pole on the lot line. In fact we are all a little prudish about them. And from our silence the customer gets the idea that overhead services are to be discussed only in private, like cockroaches with the exterminator.

A residential building boom is on and it is about time to start some plain talk about these eyesores. Service conductors are bigger and uglier. We manage somehow to hide water and gas services underground. But power and light still comes in through the trees, because it is cheaper. Why?

Lead Them Out

Some power companies have been slow to actively promote fluorescent lighting because they feared the loss of wattage that is involved. But progress is irresistible. The problem finds its answer, as it did when mazda lamps were introduced long years ago, by raising the standards of illumination and building back the wattage that way.

Contractors in cities where the fluorescent lamp lacks support from the power company are naturally handicapped. Some of them are sore. But the way out is to make the new illuminant good news to every customer and sell up lighting intensity. Show the local utility company what can be done. It will not take long to prove the case.

_Back Talk —

We Want to Help

To the Editor—"I have read the article in defense of the contractor and most assuredly agree with you that considerable housecleaning will be required by the manufacturer or by manufacturers' organizations, before the present evils in the fluorescent field are corrected. Our contacts with the smaller manufacturer and jobber or contractor have indicated very considerable bewilderment and if this is true the customers' attitude will certainly reflect this bewilderment to the disadvantage of the industry.

"I strongly believe that the publications should take the lead in insisting upon conservatism in the development of the fluorescent markets in order to eliminate, as much as possible, the usual excesses that have occurred in other fast growing markets such as the radio industry."

Harry A. Ehle

Harry A. Ehle International Resistance Co. Philadelphia, Pa.

We want to help, Mr. Ehle, and are glad to have your endorsement of our viewpoint. And really, there should not be disorder in this market, for it is not a new market, just another lighting unit.

No Inspection

To the Editor—"The tragedy of our particular section of the country is that the Light and Power Company will provide service to any building if a fuse is installed in the circuit. We are handicapped by an utter lack of anything remotely resembling regulation and inspection except in REA territory. Utility employees inform me that under Arkansas State Laws (or lack of laws) they are required to act as above.

"A few of the contractors with a sincere conscience toward their business have tried to form some kind of state organization to combat these conditions, but so far, without any results. Any suggestions you may have to offer as to how we can form a state branch of the National Electrical Contractor's Association, or any other means to obtain effective legislation in this matter will be appreciated. None of

"us are sufficiently skilled politicians to have accomplished anything of this nature in Arkansas—yet."

J. C. White Morrilton, Arkansas

The best way to get a law is to sell the idea to your representatives in the State Legislature. Surely it is in the public interest. Your idea of joining NECA as a state branch is sound. They can help you. The experience of other states is available. We hope you will press it.

Kind Words

To the Editor—"Many times I have had the urge to express my thanks to *Blectrical Contracting* for the splendid job it is doing for the contractor. Like many of our impulses, that urge has been, too often, filed for future attention. But, at last, here I am saying "Thank you". I am most happy to be of any service to you and your very excellent publication."

J. J. Newitt
Executive Secretary
Los Angeles Chapter
National Electrical Contractors Association

Modesty should prevent our running this perhaps. But we must indicate our appreciation and point out that to help the contractor is our whole job. Thanks for this thoughtful comment, Mr. Newitt.

Let's All Sift

To the Editor—"The progressive and conscientious fixture manufacturer desires to maintain the lighting fixture business for high levels of products and service. A close cooperation must be built up, linking the manufacturer, jobber, and contractor, in order to develop an accurate estimate of fluorescent lighting in the ultimate customer's mind.

"It is quite likely that the so-called misunderstanding between manufacturers, jobbers, and contractors, is due to the influx into the lighting industry of companies and individuals without knowledge of lighting requirements and illuminating experience. Our opinion for a solution of this trouble is to go along making, selling and installing higher class lighting equipment, and let time sift out those that do not perform satisfactory products and service."

Victor Williams

Mid-West Chandeller Co.

Victor Williams Mid-West Chandelier Co. North Kansas City, Mo.

We heartily agree. Time is a good sifter and will do its work here also. But that is no reason why the sifting should not be or-ganized and hastened.

Too Much Price

To the Editor—"We are doing a 'quality' job here at St. Mary's Hospital and our biggest problem is to get the suppliers to understand what we want and keep them from instantly wanting to substitute.

"Everyone seems sold on the idea that all people want cheap merchandise. We need a new viewpoint in our business; and more talk about quality. We have permitted the wrong psychology to dominate our thinking and it is time to talk about something else besides 'price'."

E. M. Raetz Rochester Electric Co. Rochester, Minnesota

You are right, Mr. Raetz, and it is our own fault. The public is more interested in quality than price and buyers are thoroughly accustomed to relating price to quality. They expect a better car to cost more. Electrical men can correct this condition as soon as they want to start selling "quality first."



OUTSIDE METER HOUSING

On the new Alazan Courts housing project in San Antonio, Tex. the Wright Bros. Electric Company installed apartment metering and distribution equipment in cabinets set flush in outside wall.

A typical cabinet, as shown in the accompanying photo, is 60 by 30 inches. The service conduit, roughed in the wall, terminates in a 100 amp. main circuit



OUTDOOR ACCESS to meters and main fuses is provided by flush distribution equipment enclosure.

breaker. The main feeder is extended in 2½-inch square duct to 6 meter switches fused at 30 amperes. Branch conduits, 3 number 8's in ½-inch, extend to circuit breaker load centers in each apartment.

SPOTLIGHT CONNECTIONS

Plug connections were used on direct downlights installed in the hung ceiling over the main sales area in Tiffany's new building in New York City. Lock type plugs, on the end of flexible conduit connections to the lamps, fit into the receptacles mounted in large square outlet boxes which give plenty of room for circuit and receptacle connections.



FLEXIBLE CONNECTIONS on downlights mounted in the hung ceiling of this building, make lamp replacements and fixture repairs a simple matter.

All outlets are mounted within easy reach of the servicing catwalks to facilitate disconnecting the units for lamp replacements or removal of the entire unit for major repairs. Lord Electric Company, New York City, were the installing contractors.

UTILIZING EXISTING CABLES

In changing over the distribution system of a number of New York State buildings at Albany, N. Y., from direct current to alternating current, the Vanderlinde Electric Corp., Rochester, N. Y., utilized the existing 1,000,000 CM. and 2,000,000 CM. single conductor lead covered cables in the underground ducts. The majority of these were run, one cable per duct, in fibre conduit under the building floor. However, one section of the duct line that entered the main switchboard room was steel conduit.

One conductor per steel conduit for direct current is permissible. But, because of the characteristics of alternating current, a steel conduit must carry cables of all three phases of the circuit. To solve the problem, the existing cables were cut and removed from this particular section of the run. Four



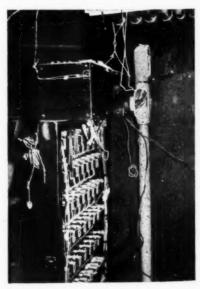
FOUR TO ONE is the ratio of small cables spliced to each existing large conductor in this changeover job. Alternating current necessitated the splitting up of the cables which entered the switch-board room in steel conduits. Old system was direct current.

smaller single conductor lead covered cables were then spliced to each of the existing large conductors in the fibre conduits. These small conductors were then fanned out and split up so each steel conduit, in the section in question, carried two parallel conductors per phase for each of the three phases. At the switchboard room end of the steel duct section, the small conductors were again spliced to the existing large conductors which entered the board through fibre conduits.

MOVABLE Panel

A control panel for the air conditioning system in a Houston, Tex. office building was located in front of a large heat exchanger. To permit repair of the equipment it was necessary to provide means of moving the control panel out of the way.

The Alan Cooke Co. electrical contractors, installed the panel so that it



CONTROL PANEL can be swung back, hinged on conduit support, to clear air conditioning equipment repair.

In the 1560's wire making was entirely a matter of individual craftsmanship. Today precision instruments in the laboratory keep check on automatic machines. The General Cable Laboratory Staff are craftsmen-scientists.

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1941



BETTMANN ARCHIVES

ROGRESS in electrical wire and cable manufacture never stands still. And, with apologies to a well-known automobile manufacturer, we say "When better wires and cables are built, look for the familiar General Cable emblem". It is a quality mark today, and always.



BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

STOCKED BY ELECTRICAL WHOLESALERS EVERYWHERE

General Cable Corporation Sales Offices: ATLANTA . BOSTON . BUFFALO . CHICAGO . CINCINNATI . CLEVELAND . DALLAS . DETROIT . HOUSTON KANSAS CITY (MO.) · LOS ANGELES · NEW YORK · PHILADELPHIA · PITTSBURGH · ROME (N.Y.) · ST. LOUIS · SAN FRANCISCO · SEATTLE · WASHINGTON (D.C.)



GENUINE

A.B.C.

Armored & Bushed . Cable

ENCASED

AND

PARKWAY CABLES

CONDUCT-ORS—Clean stripping insulation and flame retarding covering, printed as shown.

WIRE

MAGNET WIRE

CABLE

SERVICE

CABLE

BUSHING—easy to insert as paper unwraps from under both ends of armor to make room for the bushing.

STEEL ARMOR — low resistance, electro-galvanized for maximum uniformity and longest life.

TESTED — Thoroughly tested at several points during manufacture and receiving a final test of 2000 volts between conductors and armor.

CRESCENT has unexcelled facilities for the complete manufacture of Armored Bushed Cable in all its steps. When you buy CRESCENT A.B.C. ARMORED BUSHED CABLE you buy the best. Do not be satisfied with any substitute.

OCRESCENT
WIRE and CABLE

Factory: TRENTON, N. J. - Stocks in Principal Cities

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland Detroit Indianapolis Kansas City Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION



[FROM PAGE 34]

hinges on a two inch conduit upright, with the base riding on casters. Threaded fittings in the upright form the hinges and convey the circuit conductors into an adjoining switchboard pullbox.

WIRE PUSHING "TORPEDO"

A small gadget, which the mechanics call a "torpedo", has been developed by the Hixon Electric Co., electrical contractors of Boston, Mass. It is used for pushing a group of wires through the interconnecting conduits.

The device is made of a piece of \(\frac{3}{8}\)-inch brass pipe approximately one inch long. One end is closed and rounded off to form a bullet-shaped tip which holds an "Allen" sheet metal screw projecting inside the "torpedo". The other end, which is open, is threaded on the inside. Four shallow grooves, cut lengthwise along the out-



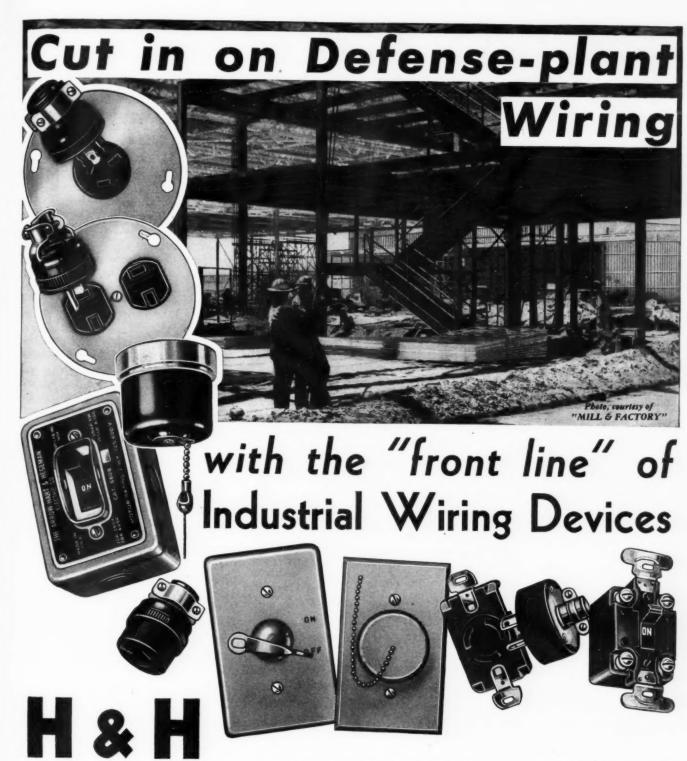
WIRING "TORPEDO" is a device developed by the Hixon Electric Co., Boston, for pushing circuit wires through conduits.

side of the pipe, facilitate gripping it and twisting it over the wires.

To use the device, the two, three or four wires, whichever it may be, are clipped and the ends inserted into the "torpedo", which is screwed on similar to a wire-nut. The sheet metal screw grips the interior of the group of wires while the inside thread grips the outer insulation of the group. Once applied, it can be removed only by untwisting it.

This "torpedo" has proved to be a remarkable time-saver for the Hixon Company, especially on short runs. It rides over conduit fitting ridges and travels around sharp bends easily. It can be applied and removed in a few seconds and it is not necessary to skin the insulation of the wires.

NON



Industrial Electrical Equipment includes (beginning with top figure above): 3-wire Receptacle with rubber Plug; 2-wire, 20 amp. Duplex Receptacle with cord-grip Cap; Type C Ceiling Pull Switch; Small Motor Starting Switch; 3-wire rubber Cord Connector; Outdoor Weatherproof Switch; Weatherproof Receptacle; 3-wire Flush Receptacle with Cap; Type C Tumbler Switch. Completeline Catalog lists many more "current necessities" for industrial jobs.

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NEW plant facilities have one objective: — to give more power to PRODUCTION. And that's the object of the wiring systems! New wiring and re-wiring jobs are planned to facilitate production through more electrical outlets and controls; more numerous and convenient power-connections.

H&H is supplying a record production of Wiring Devices for heavyduty service, of a quality assisting in smooth operation of hard-driven defense industries and others. Numbers illustrated above — listed at left are typical demand-leaders of today. Designed to help our Contractorcustomers to take a leading hand in their LARGEST JOB!

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

Electrical Contracting, June 1941



ROTATING LOCK LAMPHOLDERS

G-E rotating lock lampholders have positive holding power. A quarter turn in either direction locks the lamp so that it cannot be jolted or jarred loose. Another quarter turn in either direction frees the lamp—permits easy removal.

G-E STARTERS

G-E starters were designed by Mazda lamp engineers. These starters have correct operating characteristics to provide normal fluorescent lamp life and operation.

For further information see the nearest G-E Merchandise Distributor or write to Section D-186, Appliance and Merchandise Dept., General Electric, Bridgeport, Conn.

GENERAL ® ELECTRIC



[FROM PAGE 36]

METAL FORMS FOR CONCRETE BASES

The Beach Electric Company, electrical contractors of Newark, N. J., took a page out of the general contractor's manual when it constructed drum type steel forms for pouring the concrete bases for street light standards.

The forms consist of two semi-circular pieces of steel, each with two angle iron flanges for bolting the sides together to make a tubular form. One of these sides contains two holes which accommodate the two 2-inch elbows through which the underground parkway cables enter and leave the bottom of the light standard. A square steel plate fits over the top of the form and contains holes for the two elbows and the four long bolts which anchor the standard. A large hole in the center of this plate gives access for pouring the



SPLIT FORMS made of steel plate provide an economical and convenient means for pouring circular concrete bases for street light standards.

concrete. In this particular case, working space in the base of the standard was so limited that enough green concrete was dug out of this opening to form a pocket for the lighting transformer in each standard. Each form is 50 inches deep, is of proper diameter for the light standard used and rests on a square concrete base which was previously poured. The entire assembly is rigidly supported by cross planking over the excavation.

Considerable time was saved by using these forms, since they could be easily taken apart after the concrete had set and reassembled at some other point for another pour.



• Are you in a position where you know you can get faster production with better lighting . . . but you're afraid it will cost you too much time and money to get it?

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IVANHOE "50 FOOT CANDLER" can lick that problem for you as it has for many other manufacturers under production pressure. Its con-

tinuous wireway (wiring channels contain all wiring and operating auxiliaries) insures speedy, economical installation... eliminates up to 80% of plant wiring conduit.

... with IVANHOE

"50 FOOT CANDLER"

RLM Continuous Wireway

FLUORESCENT

LIGHTING SYSTEM

Because IVANHOE "50 FOOT CANDLER" is not a lighting fixture but a lighting system, it permits you to get light for some production without waiting for the entire installation to be completed. If you're working against time and want to cut production costs, this new and better lighting system can make time do "double-duty" for you. Write for new "50 FOOT CANDLER" Bulletin 1C...now.

In this typical weave room, Ivanhoe "50 Foot Candlers" provide 50 foot candles of illumination and speed the production of defense materials.



THE MARK OF A

THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844

Electrical Contracting, June 1941

More business for alert and aggressive contractors!

IVANHOE "50 FOOT CANDLER" is the first RLM Continuous Wireway Fluorescent Lighting System to provide higher levels of illumination at economical cost. That is the basic story we have been pounding home, month after month, to your prospects everywhere.

The advertisement at the left, for example, "talks" to 117,000 executives in May 24th BUSINESS WEEK. Similar advertisements in page size are reaching plant management men across all industry, the textile field, institutions, architects and engineers, the utility companies and the electrical trade. All in all, more than 500,000 individuals important to you.

Broadcasting IVANHOE "50 FOOT CANDLER's" benefits helps open up more jobs for you. And the exclusive features of this highly efficient lighting system cut you in at "the planning stage"—enable you to handle more and bigger jobs—make more money.





LIGHTING A PRECISION OPERATION

The Service Recorder Company in Cleveland has installed a supplementary lighting system of mazda fluorescent lamps in their final assembly and inspection department. Many of the operations in this department are as precise and delicate as those in watch making. For instance, in this particular view, the operation performed is to insert 19



SUPPLEMENTARY FLUORESCENT lighting relieves eye strain in precision assembly operations in this plant.

small rollers, which must be accurate to one-ten-thousandth of an inch, into a bearing only 4-inch in diameter.

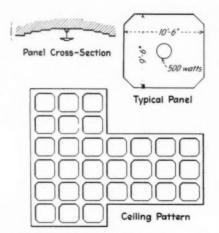
General lighting in the room is provided by 500-watt Glassteel diffusers, thus insuring good contrasts.

PANEL LIGHTING

As a part of alterations to the lobby of the National Bank of Commerce in San Antonio, Tex., a new lighting system was installed by Graham & Collins Electric Co., using the existing ceiling panels as coffers for indirect lighting.

The panels form rectangles 10-ft. 6-in. by 9-ft. 6-in. with 2-ft. beams between. The construction gives a cross-section of the panel depth varying from one inch at the edges to five inches in the center.

Shallow indirect fixtures are hung



RECESSED CEILING panels are used as coffers in this indirect bank lighting job providing 35 foot-candles of light.

in the center of each panel with the angle of cutoff adjusted to the edge of the panel. Each fixture is equipped with a 500 watt lamp and finished to match the ceiling trim. Panels are painted a flat white giving the lighting effect of a group of ceiling coffers with 30 to 35 foot-candles illumination.



NIGHT TIME SALES APPEAL—Nathan's Clothing Store, Houston, Texas, presents a quality front with an aggressive merchandising character. The huge luminous element, 12-ft. by 35-ft., assumes various colors with the season and sweeps from parapet to doorway. The luminous soffit, designed to lead prospects into the store itself, is lighted by ninety 75-watt lamps on 18-inch centers.

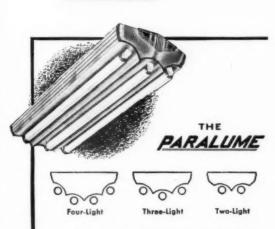
DRYER FOLDING

At the Uxbridge Worsted Company, Uxbridge, Mass., cloth 54 to 72 inches wide, all woven and colored, feeds up from the dryer to the folders, where it is checked for defects prior to shearing. The folders are lighted by two Miller fluorescent units, one at front and one at back of machine, mounted eight feet from floor, 2-feet out from machine and tilted at a 45 degree angle. A single tube concentrating unit is



LIGHTING THE SKATING RINK—Skaters in Portland, Oregon, enjoy a completely light-conditioned rink with a floor of 18,000 square feet. It is lighted to 5 foot candles by three 500-watt and twenty-nine 300-watt Curtis Edge Ray units. The edges of the fixtures are painted red, blue and green to add a touch of decoration. The bighlight exhibition skating, four lens boxes using 100-watt lamps are employed. These are flush mounted over the center of the rink. The ceiling is latticed so plywood was mounted above each fixture, to provide a suitable reflecting surface. It also makes a ceiling pattern which lends interest to the interior.





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Another original Day-Brite design—very popular for office and store lighting—available for suspension or ceiling mounting in 2, 3 and 4 lamp types... Send for complete Day-Brite Catalog.

Powerful

Sales Aids

OMPLETE product confidence is a basic part of every Day-Brite installation you sell! Because users know this, they buy and buy again!

At Day-Brite, the most rigid control of product quality is always maintained ... Day-Brite styling is distinctive and refreshing in its appeal . . . Day-Brite "OVER-ALL" Engineering Service-available at no cost to you-takes into account the individual needs of each installation, to the end that the high point in correct illumination and display engineering is always assured. And . . . the Day-Brite line is complete-whatever the call, you can fill it with Day-Brite!

It is these things that sell fluorescent—that build a substantial reputation in a fast-growing field, where Day-Brite offers you the sound advantages of 18 years' specialized experience in commercial and display lighting.... Distributed nationally through all leading electrical supply houses.

Details of Kingsway and Day-Lume

SIZES... Kingsway - IN UNITS, 2, 4, 6 and 8 ft. long - also continuous for 2 and 3 rows of lamps... Day-Lume-sus-PENSION TYPE, four and eight 40-watt; two, three, four and six 100-watt. DIRECT CEILING TYPE, four and eight 40-watt.

DAY-BRITE LIGHTING, INC. 5438 BULWER AVE. . . ST. LOUIS, MO.

Manufacturers of The Complete Line of

y Brite FLUORESCENT LIGHTING FIXTURES

ENGINEERING LAYOUTS! DESIGN APPEAL!! PRODUCT QUALITY!!!

Electrical Contracting, June 1941

FLUORESCENT Installations

with WHEELER RLM LIGHTING UNITS



RLM TWO-LAMP UNIT

Wheeler RLM Two- and Three-Lamp Fluorescent Lighting Units are designed to provide general and localized illumination in industrial and commercial areas. These units, which employ 48-inch, 40-watt lamps, can be mounted Individually from chain or conduit; or can be used to make Continuous Run installations. Only a few extra parts are required to convert units into Continuous installations of any number of units desired.

Two- and Three-Lamp Units consist of a wiring channel and a separable porcelain enameled reflector body. Both units are constructed in such a manner that upon removal of the lamps the reflector bodies can be lowered and taken down without disturbing any of the lamp operating equipment.

Units are furnished complete with lampholders, removable starter switches, high power factor ballasts and starting compensator.

This new line of equipment for Individual or Continuous installations is fully described in Wheeler Bulletin #66.



Send Coupon for YOUR Copy of Bulletin No. 66

WH	EELER	REF	LECTOR	COMP	ANY
275	Congr	***	Street.	Boston.	Mass

Please send, without charge, copy of New RLM Bulletin No. 66.

Company

Distributed Exclusively Through Electrical Wholesalers





[FROM PAGE 40]

mounted inside machine 7-feet above floor. Both faces of cloth can be seen at the same time. In that color is not important, white lamps are used. Illumination at eye level, 50-60 foot-candles



CLOTH FOLDERS are illuminated from front, back and underneath with fluorescent units to provide eye comforting inspection.

on face of cloth. Illumination 30 inches above floor, 30 foot-candles. With this light it is easier to locate defects on the moving cloth. Units are cleaned every eight hours.

SIXTY-FOOT CANDLES IN WOOLWORTH'S

The Malden, Massachusetts store of F. W. Woolworth Company has a new 60 foot-candle fluorescent installation. There is approximately 13,700 square feet of floor area which includes both the first floor (shown in the illustration) and the basement.



CONTINUOUS ROWS of semi-indirect fluorescent units provide 60 footcandles of general illumination in this Woolworth store.



YOU'LL make a lot more sales—and meet with a lot less sales-resistance—by selling Hygrade MIRALUMES!

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Because MIRALUMES embody an exclusive combination of features! Hygrade started the fluorescent fixture business . . . pioneered in making finer-quality fixtures . . . and Hygrade is every day telling this story to your customers in powerful national advertising!

Match this if you can!

Hygrade MIRALUMES mean finer light (Hygrade's patented lamp coating) ... positive starting and re-starting (Hygrade's patented Mirastat starters) ... lower maintenance (Hygrade's easily demountable reflectors and sturdy lamp holders) ... plus the world's only complete guarantee!

Tops in quality

Hygrade MIRALUMES are better designed and engineered . . . quality manufactured throughout . . . wired and ready to install, complete with superior Hygrade lamps . . . Underwriter's Laboratory approved . . . high power factor . . . starters easily accessible . . . eligible for FHA financing!

Write today for MIRALUME catalogue, prices, discounts. Dep't EC6, Hygrade Sylvania Corp., Ipswich, Mass.



GET BETTER PERFORMANCE WITH THE NEW MIRASTATS!

Here's the finest fluorescent lamp starter on the market...now available to all fluorescent users... the new Hygrade Mirastat! Assures positive starting and re-starting—longer lamp life—performance that's dependable!

Hygrade MIRALUMES Complete with Superior Hygrade Fluorescent Lamps

All Miralumes are ready for immediate delivery!

Hygrade Sylvania Corp., Est. 1901. Also Makers of Hygrade Fluorescent and Incandescent Lamps and Sylvania Radio Tubes.

Electrical Contracting, June 1941



PORCELAIN ENAMEL

• So far, no other reflecting surface for industrial lighting fixtures has ever duplicated the advantages of this vitreous fired porcelain enamel.

Here is the finish that gives you proper diffusion of light without a trace of reflected glare. Here is the finish that is permanent—that can never tarnish or corrode. Here is the finish that is easy to clean—by merely wiping with a damp cloth—to maintain the highest standard of reflecting efficiency. It gives you all the light you pay for—now, and for years to come.

GOODRICH INDUSTRIAL LIGHTING

Porcelain enamel finish is available throughout the complete Goodrich line, which includes all R. L. M.-approved fixtures, fluorescent fixtures, and hundreds of sizes and styles for general and local industrial illumination.

Literature is available on all Goodrich fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS



GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

Better Lighting

[FROM PAGE 42]

The units are each equipped with four 40-watt mazda F white lamps. They are spaced 14½-feet apart and mounted flush with the ceiling which is 16-feet high. There are a total of 1175 lamps in the installation.

LIGHT FOR Merchandising

The most effective approach in the selling of store lighting is one in which light is presented as a direct aid for specific merchandising purposes. These include:

- Attracting attention by means of of brightly lighted show windows and appropriate luminous signs and architectural treatment.
- (2) Creating a cheerful and inviting atmosphere for the interior.
- (3) Creating differentiations in brightness to call attention to featured displays, goods in cases, innovations in service, thus stimulating impulse buying.
- (4) Facilitating circulation and, by brightness control, drawing store traffic through desired routes.
- (5) Revealing merchandise on counters and other selling areas with ample illumination of proper quality to permit prompt appraisal of texture, color and other qualities, thus promoting quicker sales and reducing returns of merchandise.

In the accompanying chart, developed by the Nela Park Engineering Department of the General Electric Company, are shown steps in illumination values



NO SPECULAR REFLECTION—The body-in-white assembly stage of making Packard automobiles in Detroit requires good light that is free from annoyance due to specular reflections. Here 40/50 f.c. of mercury vapor illumination was provided by placing 400-watt units on 12 by 14 ft. centers.

You Can Get Orders Like This

Here is the installation at the Continental Car-Na-Var Corporation, Brazil, Indiana

Figure what you would have made on installing this Teletalk System. You don't need to be in a big city to get orders like this! — Brazil, Indiana has less than 10,000 population. There are scores of similar sales opportunities all around you, no matter where you are located . . . in stores, offices, shops, institutions . . . large or small.

Then, too, you make a friend when you install Teletalk—because, as Mr. D. E. Smalley, General Manager of Continental Car-Na-Var Corporation says, "It does everything expected of it every moment of its operation. It has never failed or even fumbled in a single instance."

Why don't YOU look into this Teletalk business?



These are the Materials and Labor used on this job:

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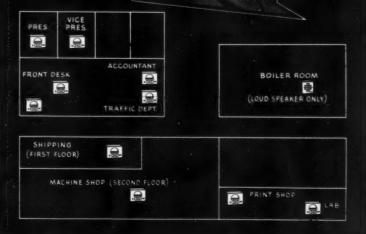
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10 Model 110 Teletalks 1 Model 5A45 Speaker 5000' Wire 26' Lead Cable Rubber Covered Staples 30 Hours Installation Time



Licensed by Electrical Research Products, Inc. under U.S. Patents of American Telephone and Telegraph Company and Western Electric Company, Incorporated

WEBSTER ELECTRIC COMPANY, Racine, Wis., U. S. A. Est. 1909. Exp. Dept.: 100 Varick St., N.Y.C. Cable Address: "ARLAB" New York City

WEBSTER



ELECTRIC

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF TELETALK INTERCOMMUNICATION AND PAGING SYSTEMS . POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT . RADIO PHONOGRAPH PICKUPS . IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNESS

Floodlights on Modern Monotubes

These modern steel poles are designed especially for floodlighting service. Height, strength, ease of erection, wiring and maintenance—all are provided for when you specify Monotubes.

The Monotube pole illustrated is designed to carry a single lighting unit and is made in lengths to provide mounting heights from 20 to 30½ ft. Other Monotubes, of either plain round or fluted design, are available in lengths up to 90 ft. for mounting from one to twenty-four floodlights.

Complete engineering service is yours at no extra cost. Write for copy of Catalog No. 70A today.



Better Lighting

[FROM PAGE 44]

which are significant for these purposes. The specific values are to be considered as typical. Whether, in a given case, they should be higher or lower than those shown will depend upon such factors as traffic, neighboring competition, qualities which give the merchandise value, reflection factor of goods, types of luminaires, etc.

There is today a wealth of new lighting materials with which to create those patterns of brightness and color which will best project the desired mood and most successfully direct the customers' purchases. Through their skillful application the sale of lighting

RECOMMENDED VALUES of illumination intensities for the various phases of store lighting are given in the above chart. Specific local conditions in each store may dictate higher or lower values.

can be substantially augmented in a given store and additional buyers found who are not responsive to the old methods.

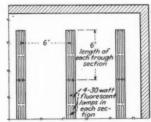
Lighting an APPLIANCE SALES ROOM

PROBLEM—To provide illumination of good quality in a sales room devoted principally to major electrical appliance sales and display.

CONSTRUCTION DATA—The sales room dimensions are 55-ft. 8-in. by 21-ft. 9-in. The ceiling height is 11-ft. 8-in. finished with a light colored acoustical material. The walls are painted a flat white.

SOLUTION OF PROBLEM—General illumination is provided from a series of flush troughs recessed in the ceiling. The troughs are parallel to the shorter wall, spaced on 6-ft, centers. The troughs contain double rows of 30 watt fluorescent lamps, end to end, made in six foot sections containing two 2-lamp ballasts. Total of 186 ft. of trough used.

RESULTS—Average illumination in the show room is 85 foot-candles. The area per lamp is 9.75 sq. ft. or approximately 3.1 watts per sq. ft. net lamp load.

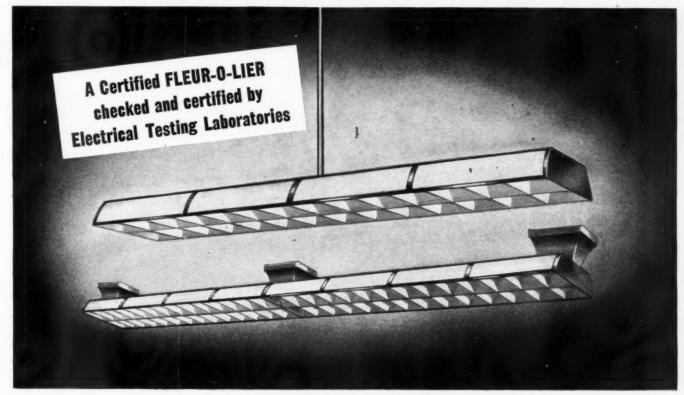


PLAN DETAIL showing trough spacing and lamp arrangement.

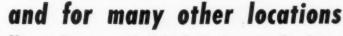
FLUORESCENT LIGHTING in ceiling troughs in an appliance salesroom.

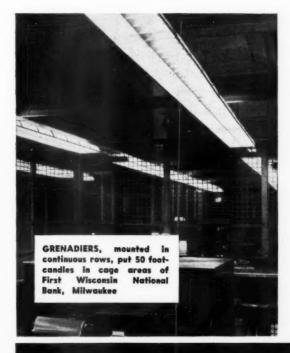


New Wakefield Plastic GRENADI



Helps you lick a TOUGH PROBLEM for banks





rs he

> How to have enough light in bank cages, for fast accurate seeing, has always been a tough problem for banks with high ceilings. The installation photograph at the left shows how the new Wakefield plastic GRENADIER can help you lick this problem, and provide better light in many other locations, to bring your customers faster, more accurate seeing and less eyestrain.

> The new plastic GRENADIER is a certified Fleur-O-Lier. It is checked and certified by famous Electrical Testing Laboratories to meet 50 essential specifications for good light, balanced performance, trouble-free operation. You know it gives fluorescent at its best!

Use these features to speed your sales

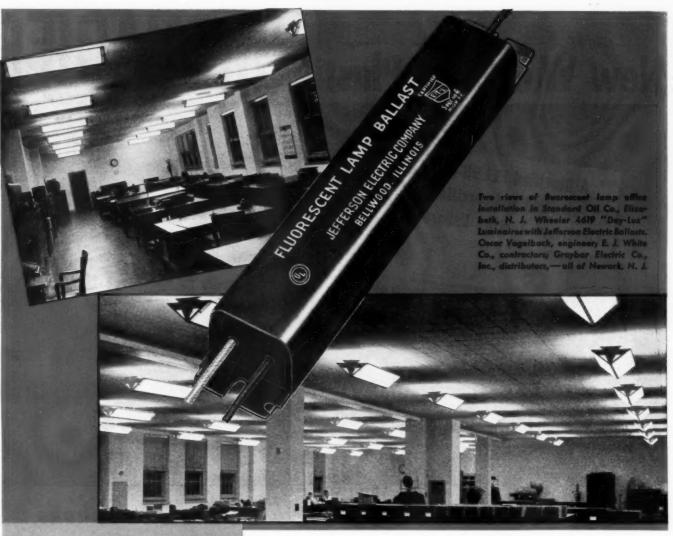
- New plastic GRENADIER provides efficient, semi-indirect light-
- Has open top reflector for lighting ceiling area . . . inverted reflector for high-level illumination.

 Well shielded—may be interconnected on factory order for continuous "suspended troffer" lighting.
- Low maintenance cost . . reflecting surfaces face downward. Easy lamp replacement through top of reflector. Write us for full information about this new unit.

Wakefield also makes many other lighting fixtures for commercial use.

F. W. WAKEFIELD BRASS COMPANY

61 Contract Park, Vermilion, Ohio





CERTIFIED BY ELECTRICAL TESTING LABORATORIES

Lamp design — electrodes, filling pressures, length, diameter, current density, voltage and current, etc.—is based on the best performance of lamps for efficiency, maintenance, life. These basic factors determine the units of electrical specifications for ballasts.

Because of these requirements, the MAZDA lamp manufacturers guarantee the performance of their lamps only when used with those balasts which meet the specified performance, as tested by Electrical Testing Laboratories, or other laboratories of recognized standing. This is a tegical safeguard set up by the MAZDA lamp manufacturers to insure proper lamp performance. Underwriters' Laboratories' approval of equipment requires that the device meet established standards as for eachie hoxard and danger to life and property are goncerned.

Your self-interest and the ultimate satisfaction

Your self-interest and the ultimate satisfaction of your customer should prompt you to be sure you get Ballasts with the "E.T.L." Certification label or insignia stamped in the case.



Listed as Standard by Underwriters' Laboratories, Inc.

INSURE FLUORESCENT LIGHTING RESULTS

REATER efficiency, improved workmanship, less eye-strain are recognized benefits of fluorescent lighting. To insure the utmost in fluorescent lamp performance, experienced lighting engineers and contractors select Jefferson Electric Ballasts because of their correctness of design and dependable uniformity.

That these qualities are widely recognized is attested by the fact that over half a million Jefferson Ballasts have been installed during the past year . . . They are made for fluorescent lamps of all capacities up to 100 watts, fully described in Bulletin 411-FL . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 60-64 Osler Avenue, W. Toronto, Ontario.

JEFFERSON ELECTRIC FLUORESCENT LAMP BALLASTS

DW—SAFETY NTENANCE

SAFETY PROTECTION FOR ELECTRICAL OPERATIONS

ever, when speeds are increased and outputs stepped up, experience has shown that accident frequencies have a habit of rising along with them. Under present conditions-when elimination of interruptions has become plant management's most important watchwordit will therefore be well to review the whole question of safety protection for

electrical operations. The old adage about the ounce of prevention, carries more punch than it ever has before. Accidents don't hap-

pen; they are caused.

In looking back over his experiences, the plant electrical man will realize that there are five major factors that work against safe operation. Let's look them over here, for safety's sake. The five factors, which pretty well cover the ground, are: (1) human factorscarelessness or ignorance or downright disobedience of rules by workers or others who have access to dangerous equipment; (2) incorrect application of equipment; (3) incorrect installationwhich often means incorrect protection of the right equipment; (4) the right equipment, correctly installed, but overworked; and (5) improper maintenance of the right equipment, even though it was installed correctly in the first place.

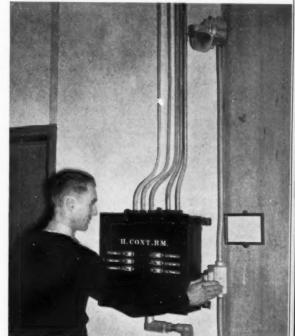
1. Human Factors

The precautions needed to guard against the human factor are relatively

SAFETY is, of course, always a few. But the plant electrical man has "first" in efficient operation. How- got to be hardboiled about them.

First, he should insist that only qualified persons are permitted to tamper with electrical controls or other equipment that have the least element of danger about them. This fundamental

TEN SHORT, sharp blasts in rapid succession from this call and emergency signal warn of fire or explosion. A dust-tight button station and horn are at both ends of each floor.



In the past we have been discussing methods of increasing the productive capacity of industrial plants through the rehabilitation of electrical systems and the use of the proper type of modern equipment. Now we consider the safety of the machine operator. For he is

AND NOW-SAFETY

N the past we have been discussing methods of increasing the

ment. Now we consider the sarety of the machine operator. For he is also a vital part of production—particularly at the present time, when skilled labor is at a premium and lost time due to accidents will affect production schedules.

What can be done to prevent such accidents? Where does the electrical man and management fit into the picture? Well, it's the electrical man's duty to suggest methods of making the operation of electrical equipment safe to operators who, although skilled in their own field, may be unfamiliar with electricity. And through his knowledge of this equipment, its operation and limitations, he knows just what steps to take. Perhaps the solution lies in a set of rules for machine operators, a warning sign machine operators, a warning sign properly placed, an electrical inter-lock or photo-electric control on the machine, a new piece of equip-ment specially designed for existing ment specially designed for existing operating conditions—or a combination of these and other methods. And once these suggestions are made, it is management's responsibility to see that they are considered and the changes made. The following pages discuss, in detail, five major factors that affect safety—and what to do about them. The accompanying Maintenance Guide Sheet lists a number of suggestions for safety protection

of suggestions for safety protection of electrical operations.

Previous articles covered-

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I. Simplifying Electrical Maintenance

2. Preventive Maintenance of Dis-

tribution Systems

3. Preventive Maintenance of Electrical Equipment

4. Reducing Power Costs

5. Maintening Good Power Factor—Part I

6. Maintaining Good Power Fac-tor-Part II

7. Meeting Severe Service Conditions

8. Eliminating Causes of Severe Service Conditions 9. Providing Adequate Capacity

for Increased Demand

Electrifying Operations to Reduce Unit Costs
 Sefety Protection for Electrical Operations (this issue)

Future articles will discuss-

12. Increasing Flexibility of Electri-cal Service

Extending Automatic Control
 Methods for Handling Change-overs and Live Circuits



A MAGNETIC SEPARATOR, relay system, and alarm installed at the Buckeye Cereal Co., Massillon, Ohio. On overload, the separator diverts the flow of grain; the alarm calls attention to the trouble; and the relay system allows the drive to continue, to clean out the mill. In addition to the time saving, the prevention of chokeups means much less wear and tear on the equipment.

idea is usually easy to "sell" to management-the problem is to get management behind a strict enforcement of the rule, especially where a department head or a machine operator thinks he can "save time" by attempting an adjustment or minor repair on his own hook, rather than waiting for a plant electrician. For example, if a motor keeps blowing a fuse, the rule should be that a ground wire should never be removed to permit it to operate, since a very dangerous condition then exists. If for some very exceptional reason the motor must be operated for a short time (say, to save a heat in a foundry), an electrician should guard the motor and prevent anyone from touching it.

Where possible, important controls should be in a separate, locked room, with only electrical men permitted to handle the keys. Incoming service transformers should be in locked vaults, with prominent danger signs displayed. Outdoor service transformer stations should be suitably protected by fences, and the public warned away by danger signs. Transformers and switching equipment should further, if possible, be mounted well out of reach.

Safety rules for the electrical crew itself should also, of course, be rigidly enforced. A red warning tag on a circuit being worked on should be removed only by the man who put it there, except under the most unusual circumstances, with all necessary precautions observed. Men should not be permitted to work things "hot" just to save a little time or trouble. And where a job calls for rubber gloves, removal of one or both just to avoid a little clumsiness should under no circumstances be condoned.

2. Incorrect Application

Since the head of a plant electrical department invariably has a voice in the selection of electrical equipment, the problem of initial incorrect application is usually not troublesome. However, for safe practices the electrical maintenance man must keep on his toes in two important respects: (1) changing plant conditions may make an installation, originally sound from every point of view, unsafe under current use, even though electrically or mechanically it may still be doing the job; and (2) improved equipment may be available for certain applications that was not obtainable when the original installation was made.

For example, changes in atmospheric conditions might make the arcing, sparking, or temperatures of controllers, cutouts, switches and contactors of auto-transformer starters, etc., extremely dangerous. Under such conditions it might be advisable that motor controllers be of the remote-control type, with the main contactors located where the hazardous conditions do not exist, and with auxiliary pushbuttons at the most convenient points.

Again: installations of spray booths or other fume-producing equipment might make it advisable to replace existing lighting fixtures with explosion-proof types. Or the wiring installation, entirely satisfactory for the original service, may be hazardous under present use.

Manufacturers are, of course, continually bringing out new or improved equipment, and the electrical man should be quick to seize the safety advantages of such developments. Phototube devices for setting off alarms or shutting off power to prevent jam-ups or to keep the unwary away from danger points are an example. In this connection, too, the plant electrical man should keep up a "live file" of conditions for which improved equipment has long been available, but for which a front-office authorization has not yet been obtained. Perhaps dead-front or cubicle-type switchboards should now definitely replace certain open-type ones, where exposed live parts on the front might be especially dangerous under current, more crowded conditions, with many "green" workers in that location. Or perhaps grille work might be the answer there. Again, the time might now be ripe to stress electrical interlocking on certain equipment where it has long seemed feasible. Or quick-reset circuit-breakers instead of fuses, with perhaps finer adjustments on the kick-out in view of less experienced people at the machines.

A word here should also be said about

illumination, since the lack of adequate lighting is a definite enemy of safety. Illumination levels have a habit of going down imperceptibly, as lamps dim through dust and grime or because they have lived beyond their useful life. Then, too, lighting developments have been so rapid in recent years, that the electrical maintenance man owes it to his plant's employees to see whether he is really doing all he can to provide safe "see levels."

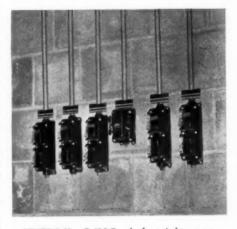
3. Incorrect Installation

No electrical man worth his salt would care to be accused of incorrect installation. He knows better. But there is one insidious way in which it often comes about: Motors or other equipment are installed for temporary use, and then the operation drags on and on, with the result, for all practical purposes, turning out to be an incorrect permanent installation.

Thus, inspectors may find conduit improperly supported or terminated, switches improperly mounted or enclosed, other than heavy-duty cord used for extensions, and loose, open, "temporary" wiring. Now is a good time to keep a special eye open for violations of this sort.

But perhaps the most dangerous condition to discuss under this head is improper grounding. It has, unfortunately, been the cause of many a fatality.

Apparatus can reach a high potential relative to the earth by being "charged" or by the insulation breaking down on a current-carrying conductor in contact with the apparatus framework. The National Electrical Code is quite specific in its grounding requirements, and no plant can afford laxity. Obvious types of equipment that should be grounded include conduit pipe, motor frames, electric switches and starting



TYPICAL GANG of dust-tight, startstop motor switches. Removable stamped tags identify each circuit by number. Starters operated by these switches are in segregated control rooms.

SAFETY PROTECTION for ELECTRICAL OPERATIONS A CHECK SHEET

The five heads under which the safety pointers in the accompanying article have been developed are quite inclusive—and discuss the subject in terms of practical experience. To make possible a quick review, this check sheet is offered. It lists important electrical safety reminders in an orderly sequence, following the flow of power from service entrance to point of use.

1-INCOMING SERVICE TRANSFORMERS

A-Outdoors-mount out of reach; guard fence; danger signs prominently displayed; gate locked; key only to authorized persons

B-Vault-locked door; danger signs prominently displayed

C-Use transformers with non-inflammable insulating oil or liquid

-SWITCHBOARD-OPEN TYPE; EXPOSED LIVE PARTS ON FRONT

A—Insulating mat—wood; rubber; cork; linoleum B-Grille Work-at ends and back of board; access door locked if space permits

C-Wood or composition cubicles for switch jaws, to prevent closing of switches

D-Close knife switches preferably with one hand and quick steady movement

E-Use circuit breaker to open circuit, not knife switches

F-Ground metal framework-except that the frames for d-c single polarity switchboards may be insulated for the full voltage of the circuit

G-Not to be exposed to moisture

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H-Shall not be built up to a fireproof ceiling

I-Use wood pole to open main disconnect switch on primary services

3—SWITCHBOARD—DEAD FRONT; CUBICLE TYPE A—Ground metal framework

B-Grille work at ends and back

C—Shall be mounted in cabinets or cutout boxes

D-Ground instruments, relays, meters and instrument transformers on switchboards

E-Each authorized man to have lock and key for locking or opening circuit on which he must work

-DISTRIBUTION SYSTEMS

A-Open circuit runs-protect from damage

B—Underground service conductors protected against mechanical injury-install in duct, conduit, electrical metallic tubing or auxiliary gutters

C-Conduit runs grounded

D-Avoid damage to insulation when pulling in conductors

E-Power and light transformers; guarded if on floor, or elevate, casing grounded, use oil retaining curb if oil cooled transformers are used

-INSULATION RESISTANCE

-Check periodically, reasonable factor of safety, N.E.C. paragraph 3018 B—A.I.E.E. formula: Voltage at terminals Resistance in megohms = KVA rating + 1000

CIRCUIT PROTECTION

A-Fuses for sizes of conductors, N.E.C.-take into consideration starting current

B-Circuit breakers or fuses in distribution panels

7-GROUNDING

A-Framework, motors, machines, conduit and other metal raceways or enclosures for conductors

B-Connections of suitable capacity

C-Grounded detector on main bus or principal

D-Connection on extension cords to portable tools

8-LOW-VOLTAGE PROTECTION

A-Compare with low-voltage release-machine will not restart when voltage returns, operator must press start-button

B-Maintain circuit if dip is less than 4 seconds

-OVERCURRENT PROTECTION

-Feeders; circuit breakers, O.L. relays, settings B-Operating equipment; control, O.L. relays, set-

C-Fuses; ratings no greater than the allowable carrying capacity of the conductor

D-Time-delay circuit breakers of thermal-trip type with fixed settings; rated at not more than allowable carrying capacity of the conductors as specified in N.E.C. paragraph 2403

E—Circuit breakers of time-delay magnetic trip type; setting of no more than 125 percent of the allowable carrying capacity of the conductors

F-Instantaneous circuit breakers; to operate at not more than 125 percent of the allowable carrying capacity of conductors

-CONTROL CIRCUITS

-Devices for emergency stops

B-Interlocked control circuits in continuous proc-

C-Push buttons, limit switches, electronic control D-Transformers; isolate the circuit

E-Signal lights and alarms

11-WORKING ON FEEDERS AND CIRCUITS

A-Open switches or circuit breakers; lock in open position and remove circuit fuses or, use dummy fuses where switches can not be locked open and may be closed by someone

B-Liberal use of tags "Men Working"

12-OPERATING EQUIPMENT

A-Lights; avoid vibration, enclosing conductors in dust, moisture and hazardous locations, removing

B-Motors; thermometers for temperature rise, protection for dust and moisture, hazardous locations, adequate ventilation

C-Starters and other controls; enclosed, dust, moisture, etc.

13-STATIC ELECTRICITY

A-Grounding-conducting rubber mat for grounding static charges

B—Belt dressing

boxes, electric heaters, transformer cases, and portable equipment, such as drills.

Motor frames should have the ground wire soldered in or firmly clamped to a slotted lug, and held tightly under the end shield bolts. Cable to portable tools should have an extra grounding conductor, readily distinguishable from the circuit conductors. An approved multi-prong plug or its equivalent must be used, one prong for the purpose of connecting such grounding conductor to the ground metal raceway or cable armor. The Code also permits a separate flexible wire or strap, insulated or bare, protected as well as practicable against mechanical injury.

The Code recognizes a continuous metallic underground water piping system as a preferred ground. It is well to remember that the size of the conductor by which the machine is connected to ground is important. If the wire is too small, a ground may cause it to burn off before the fuse or circuit-breaker goes, leaving a dangerous and perhaps fatal grounded condition. Since grounding is of first importance in electrical safety precautions, the Underwriters' approve grounding conductor sizes as given in the accompanying table.

Size of Largest Service Conductor	Copper wire No.	Conduit or Pipe (Inch)	Electrical Metallic Tubing (Inch)
2 or smaller	8	3/3	3/2
1 or 0	6	1/3	1
00 or 000	4	3/4	11/4
Over 000 to 350,- 000 C.M	2	2/	114
Over 350,000 to	2	24	174
600,000 C.M	0	1	2
Over 600,000 to			
1,100,000 C.M.	00	1	2
Over 1,100,000 C.M	000	1	2

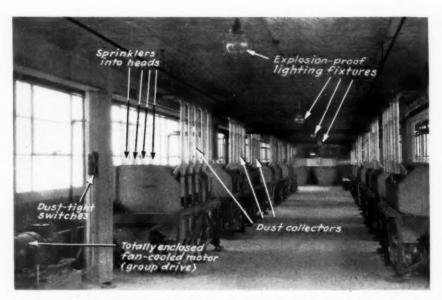
Conduit, pipe, or electrical metallic tubing cannot be used alone as the grounding conductor for a wiring system. See paragraph A of N.E.C. section 2591.

4. Equipment Overworked

Under production conditions today, the chances of electrical wiring and apparatus being overworked are very good indeed. Aside from inefficient operation, overloaded equipment means heat —a definite fire and safety hazard.

One element in this overload situation is that where fuses keep blowing or breakers keep popping, some workers are inclined to take matters into their own hands. Either they short out the protection, overfuse, or tamper with relay settings.

Inadequate wiring, under normal conditions a problem in many plants, will today be put under an additional



THESE GRAIN ELEVATOR heads at the General Foods, Kankakee, Ill. plant illustrate some preventive and precautionary measures for the protection of electrical equipment in locations where dust creates explosive hazards.

strain, as feeders and branch circuits are extended to accommodate new areas and additional machines. The electrical maintenance man will have to do his best to keep up with expansion, with frequent voltage checks on the internal distribution system.

Of course, rewiring is no easy or inexpensive job, and is not one to be recommended lightly to management. A watchful eye on power factor will often make it possible to ease the currentcarrying burden on systems that cannot be conveniently enlarged at the moment. Better scheduling of machine use is another possible help, as is, perhaps, interlocking of some equipment to prevent too great a load from being thrown on the system at once. Changing load centers may also make it advisable to shift the location of a transformer to improve voltage regulation, with higher voltage at the motor reducing the current necessary for a certain power output, and hence reducing overheat condition.

5. Improper Maintenance

In recent years, emphasis has increasingly been on the preventive rather than the "fix-it" type of maintenance. Prevention is the very heart of safe operation, since the objective is to avoid time-consuming and perhaps injurious or fatal accidents, rather than to patch up after they have occurred.

Surprise is the enemy of preventive maintenance. Therefore every attempt should be made to organize a systematic periodic check on all equipment. Operations vary too much among different plants to make it possible to set down general rules. Inspection intervals for motors, starting devices,

transformers, and the like should be set up much shorter than are probably necessary, and then records should be kept over a long enough period to permit the intervals gradually to be lengthened to suit the plant's operating conditions.

Definite things that the inspectors must look for should be set down in writing, together with definite routine operations on each check, such as cleaning and adjusting contacts. Report forms should be provided on which they can indicate out-of-the-ordinary conditions that require attention.

Expensive trouble at a later time can be avoided if an accumulation of little things are not permitted to pile up. Such little things include cut-out and switch boxes going bad, with covers loose or missing, or with box rusted; broken and deteriorated lighting fixtures that need replacing; panel boards, cut-out bases, and switch bases cracked or broken, oil-soaked windings with rubber deteriorated by oil, breakdown resistance of transformer oil below the acceptable minimum, etc.

Such periodic inspections will also help avoid the condition mentioned under the previous head. Temporary wiring and other installations will not gradually become, to all intents and purposes, permanent. Specific intervals should also be set up for more elaborate surveys on power-factor conditions, insulation resistances, illumination levels and the like.

Soon a body of data will be built up that will enable replacements and repairs to be effected before breakdowns and possible injuries occur. And they will be made at times that fit in most conveniently with the operation of the plant as a whole.



Morse has attempted to produce rotors of this type . . . the advantages are too widely recognized for that. It's because only Fairbanks-Morse

It took a great deal of time and money to find

Chicago, Illinois. Branches and service stations throughout the United States and Canada.

*Copper has a high melting point (2000° F as compared with 1100° F for aluminum), higher electrical conductivity, and better thermal expansion characteristics.

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DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

FAST CAPACITORS

Use FAST capacitors for better voltage regulation, reduced feeder losses and improved power factor.

FAST capacitors are well designed, carefully built, rigidly tested. They are made by capacitor specialists.

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Vibration Relief for Lighting Fixtures

In the rayon mill of Aberfoyle, Inc., Norfolk, Va., lamp replacements were excessive. Lighting fixtures for the first floor are suspended by drop cord from an outlet box on the ceiling, and vibration caused by the operating looms on the second floor (wood) was transmitted to them. Because lamp filaments do not stand vibration, it was necessary to replace the lamps frequently.

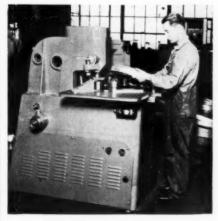
To overcome this difficulty a simple device in the form of a U-shaped spring is used. The device is attached to the drop cord so that the cord has a small loop. With this arrangement the vibration is not transmitted through the cord but is absorbed by the spring. The spring is made of No. 10 phosphor bronze smooth wire.

Electronic Controls Start and Stop Trimmer

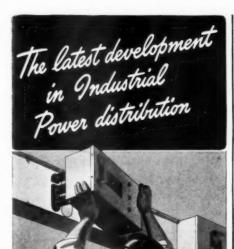
Photoelectric and time-delay controls have replaced a conventional foot-operated treadle on a machine for trimming stampings. Simple round stampings can be trimmed at the rate of 120 pieces per hour. This production is secured with more convenience to the operator on jobs where the same operation is repeated many times.

For the trimming operation the stamping is positioned on the machine, then the operator simply passes his hand through a light beam focused on a phototube and the machine starts to trim the stamping. The operation is timed by a vacuum-tube timer relay so that at the completion of the cut the machine opens automatically for unloading.

The adjustable time delay of the timer relay is obtained in the conventional



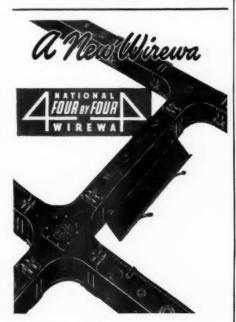
ELECTRONIC CONTROLS, consisting of photoelectric relay and vacuumtube time-delay relay, operate trimming machine.



I.F.B.—Industrial Feeder Bus and I.P.I.—Industrial "Plug-in" Bus embody the latest improvement in the enclosed busbar system of electrical power distribution. Write for litera-



Rational Electric



4 x 4 Wirewa may be mounted direct to the wall. No projecting brackets necessary. Quick and easy to install couplings. Only two bolts to tighteq. Quick access to the full length of wireway. Investigate—Write for literature.

Rational Electric



"Plug-in" Strip

The new "Plug-in" Strip method of Circuit Wiring, developed by National Electric Products Corporation, Pittsburgh, Pennsylvania, provides adequate outlets every 6, 18 or 36 inches all around the entire room—literally "Outlets by the Yard."



The strip is easily installed directly on top of the baseboard or beneath the baseboard trim. "Plug-in" Strip comes in 6", 1', 18", 2', 3', 6' and 9' lengths. It is finished in black and it can be quickly painted to match any color.

Write to National Electric Products Corporation at Pittsburgh for the booklet they have just issued on this material—adv.

Mechanical Connectors

The National Electric Products Corporation of Pittsburgh, Pennsylvania, has used the orthodox method of the wedge principle in the construction of their Gorilla Grip Connector line.

The connectors embody two types of this wedging principle—the sleeve, lockring and nut and the tapered bolt and nut.

The cross-section shown reveals how the wedge principle is applied.



The connectors may be purchased in handy stock or emergency sets which makes it possible to carry 125 various combinations of connectors directly to the job without back-tracking to the stock room and losing valuable time on a breakdown.

Write to the company for literature-adv.



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YOUR MARK FOR CUTTING OR BENDING ALREADY IS ON

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teeltubes

Don't throw your foot-rule away. You may have occasion to use it for other work-but you won't need it for marking off "Inch-Marked" **ELECTRUNITE STEELTUBES. This easy-to-use** electrical raceway has a continuous foot-rule printed right on the tubing along the entire length.

At every inch is a clear, accurate mark—at every foot is a number designating the length from the original end. Thus, when a cut or bend is to be made, you merely count off the distance -and there's your mark.

With "Inch-Marked" ELECTRUNITE STEEL-TUBES, the new ELECTRUNITE Bender and the new ELECTRUNITE Bending Tag, you can make any standard type or radius bend with

greater accuracy and with less effort than ever before possible. The new bender is simple and easy to use-has instructions built into it. The new bending tag provides detailed directions and diagrams for making various types of bends.

Add to these exclusive advantages the light weight, freedom from threads, uniform ductility and knurled inside surface that reduces wire pulling effort-and you'll realize why "Inch-Marked" ELECTRUNITE STEELTUBES is the easiest-to-use rigid steel raceway in the world. Try it on your next wiring job-exposed, concealed or in concrete—and you'll KNOW how easy it is to use and how it can help you on the job. Steel and Tubes Division, Republic Steel Corporation, Cleveland, Ohio.

LOOK FOR THIS LABEL AND BENDING INSTRUCTION TAG



When you buy electrical me-tallic tubing, look for this label and the "inch-mark-ing." They identify the only tubing with the many advantages of ELECTRUNITE STEEL-TUBES. Look, too, for the bending tag on every bundle.





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other ways. He's a good man to know. Why not get ac-quainted with him?

For Repairing Refrigerator Motors

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You will soon need a supply of capacitors for those "hurry-up" jobs on refrigerators. We have anticipated your needs by putting in a stock of all popular sizes.

When you need capacitors for refrigerator or other. electric motors, order genuine Mallory Capacitors from I. W. I. Any of these offices will be glad to serve you.



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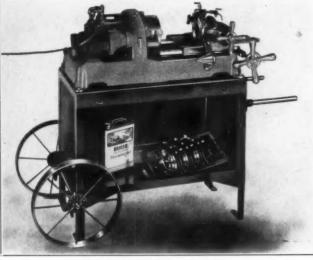
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Beaver Model-B 1/8 to 2-inch Pipe and Bolt Machine

For ½ to 2-inch pipe—¼ to 1½-inch bolts. Up to 8-inch with rive shaft and geared tools. Rack-and-pinion feed. Cast steel-iron ase and cap. All-steel geared universal pipe chuck—with safety utomatic wrench ejector; hinged full-range reamer; sliding wheel or nife cutoff; ring-type opening adjustable diehead—in hinge. Automatic gear-driven oil pump. All gears enclosed and run in oil. Choice f 110 or 220 volt universal reversible motor. Weighs about 280 lbs. a use in finest pipe shops throughout the country.

Write for Bulletin B. base and cap. A automatic wrench knife cutoff; ring-



641 DEEN AVENUE

manner by varying a resistance in series with a condenser so that a longer or shorter time is required for the condenser to build up to its full voltage. This condenser voltage is applied to the grid of a vacuum tube in circuit with a relay so that as the critical grid potential is reached the tube will operate, actuating the relay. Thus, in effect, the photoelectric control takes the place of the start button and the time-delay control replaces the stop button.

The machine is in effect a rotary shear with its cutters mounted on vertical shafts. Parts to be trimmed lie horizontally on a pneumatically operated table. Except for the phototube and light source, electric control equipment is conveniently located in the base of the machine. To facilitate set-up operations, the phototube itself can be swung away from the table. Quickwork Co., Chicago, developed the machine, using General Electric phototube and vacuumtube timer relay.

Packaging Interruptions Stop

Four or five times a month word would be passed down the bottling line at the W. & A. Gilbey, plant of National Distillers Products Corporation, Cincinnati, Ohio, that "the elevator's jammed again!" Workers would have to be at ease for a half hour while the maintenance crew cleared the

Two elevators remove cases from one conveyor line and deposit them on another two stories above. Whenever an imperfect case is stuck at discharge, the elevator, attempting to discharge additional cases, would jam, damaging at least one case, and holding up the workers depending on it for their operations.

Electric eyes now control operations



CONVEYOR at discharge end of elevator. Circles show location of cells and light beams. Two beams are directed at the same cell in such a way that a case clears the lower beam before the case ahead of it breaks the upper beam. uses jam, both beams are cut, stopping the elevator. When cases

so that the elevator automatically shuts down before an imperfect case can cause it to jam. As soon as the faulty case is removed, operations can be resumed immediately.

Since installation, more than 1,800,-000 units have been handled. Not once have the photo-electric cells failed to protect the two elevators.

Electrostatic Methods for Cleaning Air

Electricity has been put to work to clean the "breathing" air of motors, as well as to purify ventilating air in steel mills, textile mills, power plants, telephone exchanges, buildings, laboratories, hospitals, hotels, night clubs, bowling alleys and residences.

Of the industrial plants, steel mills have become the largest users of electrically cleaned air, when it was discovered that the Westinghouse Precipitron could keep heavy industrial smoke out of the cooling air that is pumped through the mill's main drive motors. It is expected that the use of these devices will greatly reduce the possibility of breakdown of these machines from the collection of soot or internal windings. Formerly such large motors had to be taken apart every few months to remove the dirt which had collected.

Equipment "Telephones" Its Troubles

A considerable amount of electrical equipment is used in wood operations at the Long-Bell Lumber Company, Ryderwood, Wash. It is supplied by a substation, located four and one-half miles from town, which receives power over a 66,000-volt transmission line and feeds three 13,200-volt distribution circuits for several logging lines.

One of the important problems that had to be solved was the installation of a suitable signal that would notify the electrical department in town when the circuit breaker on any one of the woods lines opened. Considerable expense would have been involved in building a signal line $4\frac{1}{2}$ miles long. A telephone transmitter was mounted close to the signal horn at the substation and connected to the telephone line.

This scheme has worked very satisfactorily. Whenever it is desired to check conditions at the substation it is merely necessary to take down the receiver of any company telephone in town. If the signal horn is blowing, indicating an open circuit breaker, it can easily be heard.

Electrical Contracting, June 1941

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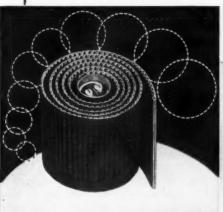
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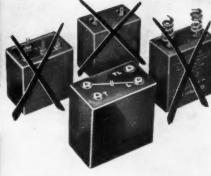
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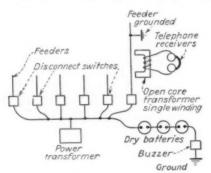


QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

FEEDER GROUNDS

UESTION 9. In our steel mill we have trouble locating grounds on our 440-volt feeder system. We have five feeders from a common transformer bank. They supply 100 or more branch circuits. We check the system each day with a test light and when a around is indicated must test each one of the branch circuits in turn until the ground is located. We cannot kill the feeders separately at the substation without seriously interfering with production. Can someone suggest a more efficient method?-J.W.B.

A TO QUESTION 9. The simplest method is shown in the sketch. The buzzer will set up a high pitch frequency and by passing



the transformer over the various circuits the grounded circuit will record the buzzer frequency in the telephone receivers. The ground can be located by continuing along the grounded circuit until the buzzer frequency fades out, as the buzzer frequency will disappear from the telephone receivers when the transformer is over the grounded spot, also if beyond the

grounded spot. All of this can be done with all lines "hot."

The battery lead which is connected to the main bus should not be connected until it has been determined, with test lamp or voltmeter, which lead (or bus) is grounded. The battery lead must be connected to the lead (or bus) that is grounded. When the battery lead is connected to the grounded lead (or bus) there will be a circuit through the feeder ground, through the ground at the buzzer, through the buzzer and battery to the feeder ground which will operate the buzzer. Do not connect battery lead to any wire, lead (or bus) that indicates potential between ground and wire, lead (or bus). This will establish high voltage through the buzzer and battery which must be avoided .-G.E.W.

TO QUESTION 9. I locate grounds on 440-volt lines very successfully, by using a 110-volt a.c. lighting circuit, grounding the neutral side and sending a signal out over the grounded 440-volt line by taking the opposite side of the 110-volt line through an interrupter and capacitor. The signal can then be followed to the fault by the use of an exploring coil and telephone receiver.—B.C.M.

TO QUESTION 9. I suggest a portable ground detector, two 250-volt lamps in each leg. This can be hung in sight at any distribution center, with a lead clipped to each phase and a common lead grounded. An electrician can then disconnect each motor or branch circuit, while someone watches the detector lamps. If done quickly production will not be affected. After the defective branch or motor is located, use a megger for final test.

This detector can also be used as a phase sequence indicator by replacing one pair of lamps with small inductance coil, and marking the bright and dim phases respectively.—G.A.K.

TO QUESTION 9. Install a bank of lights for a permanent ground indicator. Then as soon as a ground shows up, by watching the indicator and the ammeters on your feeder circuit you may be able to spot the machine acting up. Or one man can watch the indicator and another go out and open a few circuits or machines one at a time.

In our shop, our lights are all on one feeder circuit. We start a man out to open switches. When the ground clears, we open the light feeder switch for a second as a signal. Then by opening the last tested switch we know for sure that it is the one grounded. Quite a system of testing can be worked out.—W.L.C.

TO QUESTION 9. It should be possible to locate the feeder on which the ground is located with a clip-on animeter. The grounded wire of the grounded feeder will probably carry a heavier current than the other two wires of this feeder. It would then be necessary to check only the branch circuits on this one feeder.—F.C.

PLUS EXCITATION

UESTION 10. I have a 100 hp.
unity power factor motor, on a
compressor, that all of a sudden
requires 5 amperes more d.c. excitation to bring it up to unity
power factor. The rings on the
motor are clean and the brushes
are riding properly. The exciter
has been checked and found O.K.
What can be the trouble?—
N.H.T.

TO QUESTION 10. Conditions of this nature may be caused in three ways. On a small independent power system, when a sudden overload caused a change in frequency, slow speed would be responsible. By a load change such as compressor cutting in and out. By a temperature rise in windings of motor which increased internal resistance.—H.E.Y.

TO QUESTION 10. In my opinion the motor is hunting. The hunting may be caused by a temporary disturbance, such as a change of load on the motor or of frequency of supply. The motor probably has too short an air-gap, which results



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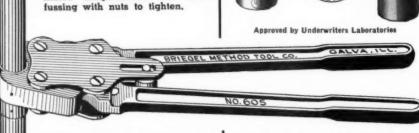
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Reader's DUIZ

[FROM PAGE 60]

in a soft electromagnetic coupling and a large per cent armature reaction. With a short air-gap there will be a large variation in the power factor of the motor from no load to full load under constant excitation, or frequent adjustment of excitation will be required in order to maintain a constant power factor. Forced hunting may be reduced by field dampers.-V.M.

TO QUESTION 10. This condition could be created by either a ground or a short circuit in the d.c. field windings of the motor. Use a megger to test for a grounded circuit. To test for a short circuit; with the motor disconnected from the line, shoot some d.c. through the d.c. field winding and check the magnetic strength of each pole. A short circuited field pole will have a much weaker magnetic field than one that is not shorted.-M.A.W.

TO OUESTION 10. Compressor loads are never quite constant. An increase in load due to developed mechanical defects in the compressor, its drive, or pressure adjustments is a cause for the trouble. A variation in primary voltage, of higher than the usual value, is another cause. If the control panel contains a line ammeter in addition to the power factor meter and the d.c. field ammeter, these causes can be readily ascertained.

Another common cause of this sudden trouble is the possibility of shortcircuited d.c. field turns which generally occur during the starting period of the This originates in defective motor. automatic mechanism contacts or the resistor controlling the short-circuiting and break-up of the d.c. field. An inspection will reveal this fault. Last, but not least, there is also a possibility of defective wiring, ammeter, and primary winding .- O.A.

TO QUESTION 10. The 100 hp. unity power factor motor may require an increased d.c. excitation current for several reasons. If the motor is running off a common supply along with several other motors of lesser power factor, the excitation current will depend on the amount of lag in the current supplied to the lagging p.f. motors. If an appreciable increase is made in the lagging load through some plant change or addition, then the unity power factor motor will require additional excitation. This is a perfectly normal action. Nothing is wrong with the 100 hp. motor.-E.R.S.

FAN CONTROL

UESTION 11. We are planning to install four large exhaust fans, probably 36-inch diameter, mounted in penthouses, with automatic shutters and 3-speed motors. This will permit varying the volume of exhausted air for different seasons. If this type of motor is installed will it interfere with later adding an automatic thermostat control for one or more of these exhaust fan units?—F.J.S.

TO QUESTION 11. Thermostatic control would be impractical with the above arrangement. For each fan, use a stop and start push button station, and a small speed selector switch with first, second and third speeds on it. Also have a small switch which would regulate "Hand" or "Automatic" operation. With this switch set at "Hand" operation, and with the speed selector switch set at either first, second or third speed, the fan could be started or stopped by merely operating the push button station.

A thermostat and relay could be connected so that when the switch marked "Hand" or "Automatic" is shifted to the "Automatic" position, the fan will start and stop within the range of the thermostat. This method of control will give years of trouble free service.—L.A.H.

TO QUESTION 11. I suggest you purchase four single-speed fans and install a thermostat to control each fan motor. Set two thermostats at the temperature you desire to maintain. Set the other two at a point or points slightly above the desired temperature. If the two fans do not maintain the temperature you desire, one or both of the other units will start to operate at the higher setting.

This method will effect considerable saving in motor and control cost and give the same results automatically with the changing seasons as you would have with manual control of the 3-speed motors. The location of the fans may determine the sequence in which they should operate to give the best circulation of air and cooling effect.—R.C.M.

A TO QUESTION 11. By installing three-speed motors on these exhaust fans you have the basis for a very flexible automatic control. The motor controller should be purchased with some automatic control in mind. The accompanying sketch will give you an idea of what can be done.

A two-pole, single-throw thermostat may be purchased and one mercury tube reversed making it a reversing switch.

TWO LIDS THAT TEACH A LESSON



• The test lid at left was filled with a good grade of ordinary insulating varnish (linseed and chinawood oil base), the test lid at right with HARVEL 612-C, the sensational phenol-aldehyde synthetic resin base insulating varnish made from Cashew Nut Shell Liquid. The lid with ordinary varnish was baked for two weeks at 220°F, but the lid with HARVEL 612-C varnish was only baked for sixteen hours. Then they were each cut in half-and look at what happened! The Lesson: HARVEL 612-C, curing by polymerization, is not dependent upon "oxidation" but sets completely dry throughout irrespective of the thickness of its application. Ordinary varnishes, which dry mainly by "oxidation," set on the surface but usually leave the interior wet or tacky. Thus, HARVEL 612-C gives better protection, especially in deep windings as in the armature shown below, and can be applied far more rapidly in multiple coats by allowing merely a brief bake between dips and a single final bake of the com-





HARVEL 612-C cannot soften or throw out and when cured, it is neither affected by acids, nor disintegrated by mild or concentrated alkali solutions. It is highly resistant to transformer and lubricating oil and maintains its insulating

qualities at elevated temperatures far better than ordinary varnishes. It may be applied in any of the usual ways and because of its excellent dip-tank stability, there is no storage loss.

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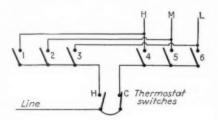
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MASONRY DRILL-POINTS

Reader's

TEROM PAGE 631

When the temperature is high H will close and C open, when the temperature is low H will open and C close. The switches 1 to 6 may be ordinary toggle



switches or may be designed into a 10 position drum switch. The lines H, M, L, go to the High, Medium and Low speed contactors.

With this arrangement the following operations may be obtained:

1. With switches 1 and 4 closed, the fan runs continuous on high speed.

2. With switches 2 and 5 closed, the fan

runs continuous on medium speed.

3. With switches 3 and 6 closed, the fan runs continuous on low speed. With switch 1 on, the thermostat con-

trols from high to off.
5. With switch 2 on, the thermostat

from medium to off. 6. With switch 3 on, the thermostat controls from low to off.

With switches 1 and 5 on, the thermostat controls from high to medium. 8. With switches 1 and 6 on, the ther-

mostat controls from high to low. 9. With switches 2 and 6 on, the thermostat controls from medium to low.

10. With switches 1 to 6 off, the control is inoperative.

This arrangement gives you ten operating positions. Many other arrangements may be worked out.-C.E.S.

TRANSFORMER

UESTION 4. In designing an industrial substation for purchased power -1000 kva.-13.8 primary -220 volt secondary-is there any objections to using a 3-phase air cooled transformer such as recently placed on the market by a well known electrical manufacturer?—J.F.M.

TO QUESTION 4. It might help to learn that we have a substation containing two transformers 250 kva., 2300-230/115-V and two 150 kva., 2300-220 open delta. These have been in operation five years and have not caused a penny worth of trouble.-J.B.C.

TO QUESTION 4. With a lower voltage there would be no objection to air cooled transform-

ers, but with such a high voltage oil cooled transformers would be preferred for moisture exclusion.-T.L.T.

Can You ANSWER these QUESTIONS?

QUESTION I -I have hooked up over 40 welding machines using 3-wire No. 4 BX for 20 hp. a.c. machines. One morning upon starting I noticed the armored cable on one machine all charred. After cutting the BX off from the machine and substituting another piece of the same make, it hasn't charred. After pulling the wire from the BX we found that the insulation on the wire wasn't damaged. Now what caused the armor to get all black and red hot?-H.F.

QUESTION J-Aircraft engines are still hard to start in cold weather. My idea would be a large 3 phase 230 volt blanket or to place strip heaters under the engine cowling large enough to warm the engine for starting with convenient connections into pits on the flying field and a means of controlling electric heat from underground cables distribution. Has anybody a better idea that will help this situation without hazardous means or excess weight to the plane? Portable steam and air blower ideas will be appreciated .- V.A.L.

QUESTION K-We have noticed that there is corrosion at a number of places where galvanized ground clamps are used on brass water pipe. At other places corrosion is not visible at the edges of the clamp and pipe. Can any of your readers explain this condition and state how it can be avoided? Is there a small leakage current from the line through the ground connection?-S.R.M.

QUESTION L-A synchronous condenser for power factor correction at its full load is approximately 400 amperes at 440-volts, 3phase, 25 cycles. Its rating is 300 kva. I was able, at first, to put the full load on the condenser by passing only approximately 53 amperes through the d.c. field. It now takes almost the full d.c. field load of 60 amperes to load it. Our power factor also seems to be suffering. Can anybody tell me why this is happening and what I can do to correct it?-O.R.F.

QUESTION M-We have two series motors of the same type operating in parallel on a hoist. We have had trouble in keeping these motors balanced. At times they would get out of balance after a couple of hours running. They may go all day. When the wind blows in a certain direction it seems to upset the balance of these motors. They also become unbalanced if the load on the hoist is changed to any great extent. I would like to know how it is possible to remedy this.-H.J.A.

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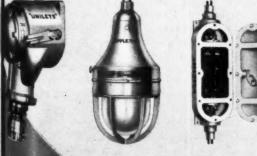
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MULTI-VOLTAGE COMPENSATOR

A single 30 hp. 220 volt three phase starting compensator handles start and running tests on 220, 440 and 2200 volt machines in a compact hook-up at the W. M. Smith Electric Co. in Dallas, Tex.

The principal elements in the circuit are three single phase transformers



COMPENSATOR CONTROLS starting for several voltages by operating on transformer primary.

with 220/440 volt primaries and 2200 volt secondaries, a 220 volt three phase compensator, a 2200 volt oil switch and an enclosed 3-pole double throw knife switch.

The compensator works on the 220 volt primary windings of the transformer. Leads are brought back to one side of the double pole switch for 220 volts. Separate leads from the 440 volt windings terminate at the opposite pole. The 2200 volt secondaries terminate at the oil switch.

Test leads for 220 or 440 volt machines are connected to the blades of the double pole switch. In the 220 volt position the machine under test is directly across the load terminals of the compensator. In the 440 volt position the transformer primary acts as an auto-

transformer with the compensator in the primary circuit. With the double pole switch open and the oil switch closed, 2200 volt test leads are energized from the transformer secondaries, the compensator acting on the 220 volt primary.

END-BELL STATOR TURNTABLE

The Hagerstown Equipment Co., Inc., motor repair shop of Hagerstown, Md., uses discarded motor endbells to make portable stator turntables.

One end-bell, fastened to a wooden cross mounted on casters, serves as the base of the table. The second end-bell, connected to the base by a piece of discarded shaft and mounted face up, supports two semi-circular pieces of wood planking. The bolts holding these wood top pieces go through the mounting holes of the end-bell. The center of the table, across the diameter of the bell, has no wood. The resultant opening serves as a chuck to hold the stators in any position desired.

The turntables are of such a height that a man can sit down while working on the motor and they can be rolled to any part of the shop desired.



HANDY TURNTABLE for holding stators is made from discarded end-bells and shafting mounted on a portable wood frame

TESTING LOAD

For heavy test loads up to 400 amperes on generating equipment the Houston Armature Works of Houston, Tex. uses an outdoor rig employing the familiar water barrel principle with some handy variations.

The equipment is mounted on a stand



WATER BARREL load has added convenience of remote control from test switchboard.

behind the plant. Three oil drums hold the water and form one electrode. Three sections of heavy water pipe are suspended from a 4 by 4 timber into the solution. The timber may be raised and lowered in wood guides at each end.

A motor operated hoist raises and lowers the electrodes, controlled by push buttons at the test switchboard. Limit switches prevent over-travel.

INFRA-RED BAKING IN A GAS OVEN

The J. J. Smith Electric Motor Co., motor repair shop of Philadelphia, has developed a simple method of using infra-red lamps for baking in their gas oven, with provisions for using gas firing at any time it is desirable.

For small work, four 250-watt reflector type lamps are used. They are mounted in medium base porcelain sockets on flexible goose-necks, fastened by mounting flanges to the four corners of a rectangular wooden frame. This frame is the same size as the interior of the oven and so constructed that it can slide on any of the oven rack supports. The flexible arms on the lamps permit horizontal and vertical adjustment of each individual lamp. The equipment to be baked is suspended



American Steel & Wire Company's Type PS Semi-Conducting Shielding (Conducting Rubber) eliminates electronic ionization of air gaps and adds years of service to the life of power cables.

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Now, American Steel and Wire Company's development of Type PS Semi-Conducting Shielding prolongs cable life by overcoming this difficulty. Type PS Semi-Conducting Shielding is always in

Columbia Steel Company, San Francisco, Pacific Coast Distributors

intimate contact with the cable insulation. It is as flexible as rubber because it IS rubber—conducting rubber! When used with rubber insulation, Type PS Semi-Conducting Shielding not only adheres to the insulation, but becomes an integral part of its surface.

The problem of producing conductivity in rubber compound without sacrificing flexibility or other rubber-like properties has finally been solved. And we now offer a proven, thoroughly tested conducting rubber compound for use in power cable construction. Write today for more complete information.



THESE PHOTOGRAPHS taken in our laboratory show a 15 watt bulb being lighted by the flow of current from a 110 volt plug-in, through an ordinary "dumb-bell" sample of conducting rubber. These tests indicate that a wide range of conductivity in rubber is available, and this conductivity can be varied to suit the best design of the cable.



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GOOD ADVICE!

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As good man power for electrical construction and motor repairs becomes scarcer in the present emergency, some smart employees are turning to a better use of tools-Why not? Much progress has been made in recent years in the development of tools that save time and effort. Certainly now is the time to take advantage of it.

Better pipe bending and pulling equipment and plenty of power tools speed the work on any wiring job. Coil making machines simplify motor repair work. It enables labor to accomplish more and soon pays for itself in actual savings. Better study your present tool equipment. See what you need.

FROM THE **EDITORIAL PAGES** Electrical Contracting APRIL, 1941

Here's How Greenlee Tools Will Help . . .

Greenlee Tools for the electrical worker lower labor costs and speed up construction by making the work easier and faster for the man on the job. Here are three popular Greenlee Tools that right now are saving contractors on defense jobs from 15 to 75% in time and labor costs. Find out how these tools, and other Greenlee Hand Tools, can help speed up your jobs . . . write for new Catalog 33-E.

The Greenlee Cable Puller, shown here, is a tool that will save many hours of work when pulling in cable. This handy tool clamps right on to the conduit through which

the cable is pulled, is easily carried to the job, can be set up in a jiffy, and is easy for one man to operate with one or two hand cranks. Write for S-115 Cable Puller folder. Greenlee Hydraulic Benders bend conduit and pipe faster . . . are easily operated by one man . . . save cost of many manufactured bends and fittings . . . are sturdy, portable, built in one unit, easily carried to job and set up, and will not move and twist about when in use. The No. 770 Bender, shown above, wil bend 114 to 3-inch conduit, while the larger No. 775 Bender will handle 3 to 41/2-inch material. Send for new S-116 Bender Booklet with description of complete line of benders.

Greenlee Knockout
Tools enlarge knockouts and holes in metal
without long tedious
drilling, reaming, and
filing. A Greenlee
Punch or Cutter is inserted in a knockout or small drilled hole and hole is
quickly cut by a few turns of the drive
nut with an ordinary wrench. Greenlee
Punches available for cutting 3/8" to
3/2" holes while Greenlee Cutters will
cut 113/6 to 3/2" holes. Write for S-114
Knockout Tool Folder.

1706 Columbia Ave., Rockford, Illinois



FROM PAGE 661

by a rod from the angle iron tray supports on the sides of the oven.

For baking larger equipment, a similar arrangement is employed using sixteen 250-watt lamps mounted, four on each side of the rectangular wooden frame. The heat from these lamps is so concentrated that they can be used outside the oven with very satisfactory results. Equipment up to 40 hp. in size can be baked with this



OVEN BAKING with infra-red lamps mounted on a removable rectangular wooden rack. Lamps can be taken out if gas firing is desired.



CONCENTRATED HEAT from this bank of sixteen 250-watt infra-red lamps baked this 2 hp. rotor in short order. Flexible mounting permits lamp adjust-

group of lamps. Stators are set on a metal plate and the lamps so directed as to concentrate the heat on the windings to be baked.

The sixteen lamps of the large bank are connected, four to a circuit and split up on the two phase power system.

According to the shop foreman, baking time on small work has been cut about 80 per cent and on large work about 40 per cent.



TOPS WITH YOUR TAPE CUSTOMERS

0

First to be Wrapped and SEALED in Cellophane

2

Perfect Adhesiveness and Tensile Strength

8

Strong Distinctive Green Core

0

Colorful Attractive Boxes

6

A Company in the Insulation Business Since 1878 Sold Exclusively Through Distributing Wholesalers

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

Wilkes-Barre, Pa.

Offices in Principal Cities

PANTHER To and DRAGON

FRICTION AND RUBBER TAPES

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GO MULTI-BREAKER Motor Cla

* WITH AUTOMATIC PROTECTION . . * NOW AVAILABLE IN A LOWER PRICE RANGE . . .

AUTOMATIC PROTECTION

SERVICE RESTORED BY TWIST OF HANDLE

NOTHING TO RENEW



NEW Industrial Type M-1 and M-2 MULTI-BREAKERS LIGHT and POWER SERVICE

Now you can offer industrial and commercial users all the advantages of famous Trumbull Multi-Breaker protection for applications requiring equipment rated at 230 Volts (AC, only) 15 to 100 amps.

These new Type M-1 and M-2 Industrial Multi-Breakers, while low in price provide complete, automatic protection against short circuit and overload. They have BOTH accurately calibrated, non-tamperable thermal-relay, time-delay trip for small overloads, and instant magnetic trip for short circuit or high overload.

Visual indication of trip is given by window target on front of box. Reset after trip by a turn of the handle . . . nothing to replace or renew. Write for new Trumbullaid Circular No. 333.



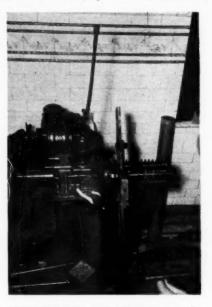


[FROM PAGE 68]

VARIABLE SPEED WINDING HEAD

A combination of a brush-shifting motor and a Chevrolet transmission is used by Howard Davies, motor repair shop in Philadelphia, to obtain a variety of speeds on his coil winding ma-

The winding head is driven, through the transmission, by a V-belt connected



VARIATIONS OF SPEED are obtained through a combination of a brush-shifting motor and automobile transmission on this winding head.

4-hp., 1750 rpm., single phase, brushshifting motor. The brushes are shifted by a spring retained lever arrangement connected to a foot pedal. Once the initial speed is set by the gear shift on the transmission, the winding speed can be increased, at the winder's discretion, by applying pressure to the foot pedal.



EQUIPMENT DISPLAY forms a prominent part of the remodeled office of the Electric Motor Repair Company, Trenton, N. J. Attractively displayed fans, motors, bearings, parts and starting equipment rest on wall shelves and counters and are the first to catch the customer's eye as be enters the office.



How to be sure about FLUORESCENT LIGHTING

1. Get Certified Fixtures. MAZDA lamp manufacturers set up 50 rigid specifications for better light and better service under which Fleur-O-Lier fixtures are tested. Certification is by world-famous Electrical Testing Laboratories of New York City.

2. Get Guaranteed Fixtures. Fleur-O-Lier fixtures are guaranteed by their manufacturers to be free from any defects in material, workmanship or assembly for 90 days. See guarantee above.

3. Choose from a wide variety. Be sure that the fixtures you buy fit your specific needs. There are over 100 different sizes and designs of Fleur-O-Liers available for your selection.

4. Get competent advice. Fluorescent lighting will serve you best if it is properly installed. Ask your local lighting company for suggestions on how to get the most out of your investment in fluorescent.

And when you buy fluorescent fixtures insist that they carry the FLEUR-O-LIER tag at the right.

Efficient lighting performance. Dependable ballasts and starters. Durability and safety.

Minimum flicker.

Ease of maintenance.

High power factor—85% or more—and 44 other rigid specifications.



It identifies Tested, Certified, Guaranteed FLEUR-O-LIERS

FLEUR-O-LIER Manufacturers

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

TEAR OUT AND MAIL

Fleur-O-Lier Manufacturers • 2122 Keith Bldg., Cleveland, Ohio Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

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APARTMENT REMODELING

On an apartment building alteration, electric ranges, new outlets, phones, mail boxes and new service were installed for 18 apartments. On several of the operations, labor data was separated as a check on estimating and a guide for future work. The breakdown is given in the following divisions.

The service consisted of three 300,-000 cm. conductors in 3-inch conduit to a 400 amp. main and a distribution panel containing 193 5-ampere 3-wire circuits. Collected together, adjoining the panel, 19 meter boxes were installed in two rows, with 1½-in. e.m.t. conduits to each group of three. Subfeeders were No. 8.

The work of installing the service and distribution panel included installing service head, switch, conduit, wire and connections to the panel bus.

Total time 40 m.h.

Connections from the service panel to the meter boxes, including conduit wire, mounting boxes, connection at service panel and meter trim for 19 meters.

Running submains for the ranges from the meter board to each apartment required the following materials:

18 Multibreakers 300 ft. No. 8 cable 200 ft. 1½-inch e.m.t. 2000 ft. No. 8 wire

The work involved running individual No. 8 circuits to each apartment during building remodeling. A small amount of cutting was required. The labor includes installing and connecting conduit, wire, circuit breakers and terminals up to the range plug.

Total time 108 m.h. Average time per range..... 6 m.h.

Connecting to 18 7.3-kw. electric ranges with flexible cable and plug.

Total time 36 m.h. Average time per range..... 2 m.h.

Finishing and installing new fixtures for the 18 apartments required removing the old fixtures and installing the new units, including handling, hanging, connecting and lamping. There were a total of 120 fixtures, including bathroom brackets, kitchen center fixtures, and lumiline brackets, closet fixtures, living room and reception hall fixtures.

Total time 105 m.h. Average time per fixture..... 87 m.h. A vestibule to apartment phone system and

door opener was installed. The system provided selective ringing, common talking, and door opening circuits fed by a ringing transformer and talking battery. Equipment included 18 mail boxes, 2 loud speakers, 18 phones, 500 feet No. 8 wire, cable and batteries.

The work included installing the above equipment complete.

Total time 74.0 m.h. Average time per phone.... 4.1 m.h.

Approximately 254 man hours were required on this job for miscellaneous rewiring other than that included in the above figures. The figures given, however, are adjusted to include a proportionate share of the total cost of lost time, handling and supervision.

Data from Block Electric Co., Chicago, Illinois.

PHOTO RECORD

Have you ever thought of using photographs in estimating jobs? The E. C. Ernst, Inc., electrical contractors of Washington, D. C., has and does just that. Here's how.

Three members of their technical staff are more or less camera fans and employ their hobby by taking pictures of any unusual bits of electrical construction they encounter in an installa-An accurate labor breakdown



ANOTHER ONE. Clifford A. Baxter, president of the Baxter Electric Co., electrical contractors of Providence, R. I., polishes off a rush estimate for one of his old customers. Cliff finds the mills up Providence way are discovering a lot of inadequate wiring these days.

of this particular operation and construction is kept for future reference. And the picture of the finished job is filed with the labor data.

When the estimator refers to this data to figure a similar job, he has a clear cut picture of what was done and the breakdown figures have a more significant meaning.

FILING CATALOG DATA

One of the most important tools the estimator has to work with is catalog data and the subsequent material prices. Without these, he is at a loss to make an accurate and complete estimate. And each bit of data has to be up-to-theminute, especially today when prices may fluctuate from day to day.

Realizing this, and being a stickler for accuracy, Charles M. Davis, president of C. M. Davis & Sons, electrical



WITHIN REACH of the estimator seated at his desk, this up-to-the-minute catalog file enables him to find data in a few minutes. It all helps in preparing quick, accurate estimates.

contractors and engineers of Harrisburg, Pa., has organized a cataloging system. Here is what he did.

In the engineering department of his newly constructed office, there are built two catalog files, bookcase type, mounted on the wall over the desk space. The one in the accompanying photograph is directly over the estimator's desk, within arms reach. Here are filed, alphabetically, all the catalogs that are regularly used in estimating the industrial, commercial and REA work that this company does. The cases are of wood and the partitions of sheet steel which slide into saw grooves.

The case on the opposite side of the same wall contains the catalogs, also alphabetically arranged, which are not used so frequently. The intervening shelf space is used for estimate forms, notes, working specifications, etc.

And each of the catalogs, whether frequently used or not, have the last minute data and price sheets in them. One set rule of the company is to have



Finally—and financially—there's extra profit for every contractor in every foot of Orangeburg Standard or Nocrete Conduit. It not only costs less, handles easier, assembles and installs faster, but is easy to get from any branch of our sales agents.

Sales Agent—Distributors

Graybar Electric Company

General Electric Supply
Corp.

There's extra profit for you in every foot of

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ORANGEBURG Conduits

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

ORANGEBURG NOCRETE for installation without concrete encasement STANDARD for installation with concrete encasement



help you to get rewiring jobs to-day. With it, buildings can be rewired quickly either for National defense purposes or general purposes. Simply replace the present wires in existing conduit with more Flamenol Wires or Flamenol Wires of larger capacity. New conduit is not necessary. Mess and expense are saved-savings which also help you to sell Flamenol rewiring jobs.

Flamenol Small Diameter Building Wire is insulated with a synthetic compound requiring no braid. It is superaging, resistant to heat, oils, acids, alkalies, and moisture. It has high dielectric and mechanical strength. It's available in a variety of bright colors in sizes

14 to 4/0. For further information and samples, see the nearest G-E Merchandise Distributor or write to Section W-186, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

Reg. U.S. Pat. Off.



You'll find the Wirometer helpful in selecting the right wire quickly when making layouts. The Wirometer permits quick calculation of conduit fill, current-carrying capacities when three or more wires are run in conduit, etc. Wirometers may be obtained from G-E Merchandise Distributors.

GENERAL (2) ELECTRIC

NEW LIFE FOR

OLD BUILDINGS



FROM PAGE 721

the new sheets inserted in the proper catalogs the minute they arrive at the office. Thus there will be no danger of using obsolete prices in preparing estimates.

What is done with the old sheets? Not all of them reach the waste basket. Those with pictures of equipment are filed away to be used at a later date when some specification reads "submit sketches of equipment to be furnished." Then the pictures are cut out and pasted to the proposal in the proper places. It saves a lot of time and does the trick, says Mr. Davis. He further adds that he never has to worry about having gone haywire on his equipment prices.

The whole setup is convenient, efficient and enables the company to turn out accurate estimates in record time.

PULLING LEAD CABLES

In a recent electrical job, the Continental Electrical Construction Co., installed an underfloor run of 3½-inch conduit which extended from an existing distribution center to a new 400ampere switch. The run was approximately 120 feet long and contained three 45-degree offsets and one 90degree bend, all made in the field. Three 500,000 CM rubber and lead covered cables were pulled into the conduit. The data given below presents a breakdown of the labor spent on that portion of the job after the conduit was in and the switch was mounted.

LABOR BREAKDOWN

MOVING REELS—includes the time spent in moving three reels, each containing 125 feet of 500,000 CM lead covered cable, from the customer's receiving platform to the job location in another part of the plant a half block away. The reels were loaded on a truck, unloaded and rolled into the proper space. Four men were required.

Total time 2.00 m.h. Average time per reel...... 0.67 m.h.

SET UP REELS—includes jacking reels on horses, in a position ready to feed cable into the conduit. Two men were required.

Average time per reel...... 0.83 m.h.

TAPING THROUGH CONDUIT—includes pushing fish tape and rope through conduit and fastening cable basket to the lead cables. Two men were required.

SET UP WINCH—includes removing the in-terior of the 400-ampere switch, mounting snatch block above switch and setting up the

winch ready to make the pull. Two men were required.

Total time 1.50 m.h.

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PULLING CABLE—the cables were fed into the conduit at the distribution end and pulled up through the switch. Due to the three offsets and right angle bend, the pull was exceedingly difficult. Four men were required.

Total time (3 pieces, 125-ft. each).10.00 m.h. Average time per 100-ft. of circuit. 8.00 m.h. Average time per 100-ft. of cable.. 2.70 m.h.

DISTRIBUTION TAPS—includes skinning the three 500,000 CM lead covered cables, sweating lugs, taping and fastening to the distribution bus.

SWITCH CONNECTIONS—includes skinning the three 500,000 CM lead covered cables, sweating lugs, taping, forming the cables to fit around the 400-ampere switch, replacing the switch interior, and fastening cables to the switch.

3.50 m.h.

This last item includes replacing the switch interior and shaping the cables around the switch and under the handle to get to the line side at top of enclosure. For cables entering the top of a switch this time would be less.

C. T. JUMPERS—includes the installation of three 6-ft. pieces of 500,000 CM rubber covered cables from the current transformer panel to the line side of the 400-ampere gear in the distribution center. Skinning cable, sweating lugs on each end and connections are included.

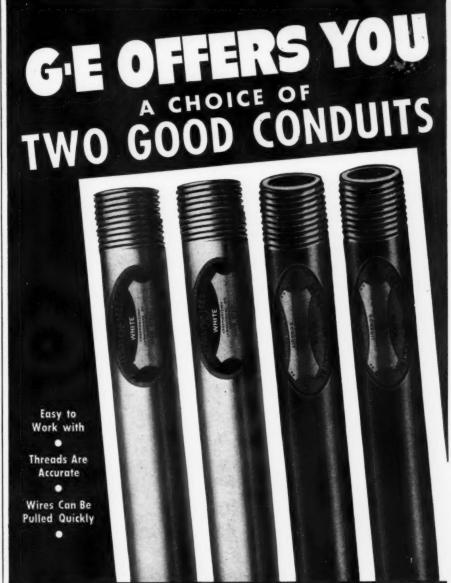
C. T. PANEL TAPS—includes the installation of short sections of bus bar in the current transformer panel, necessitated by the lack of space for 400 ampere-lugs. Includes the removal of two sets of existing lugs and the mounting of short sections of 800-ampere bus drilled to hold three sets of lugs (the two existing ones and the new one).

The setting up operation would be almost the same for an installation of heavy cable, even if the length of the run varied. The only allowance necessary would be for variance in weight.

Data from Continental Electrical Construction Co., Chicago, Ill.

Ship Wiring

Don Clayton of Birmingham has built himself a specialty, that started small in hard times, now keeps him plenty busy. It's wiring merchant ships, built at Pascagoula, down on the Gulf—defense business. Wiring is installed in a special ship cable, welded to steel bulkheads and runs into money—which is good for Don.



G-E WHITE—HOT-DIPPED-GALVANIZED

G-E BLACK - ENAMELLED

DISTRIBUTORS IN ALL PARTS OF THE COUNTRY

The right rigid conduit for the job you have to do can be found in the G-E line. This conduit is made of mild, easy-bending, rimmed steel.

G-E White is hot-dipped-galvanized and Glyptal-coated inside and out. It will give lasting protection to wiring systems.

G-E Black conduit
G-E Black is coated inside and out with a corrosion-resistant black enamel, baked on at high temperature.

Both G-E White and G-E
Black are available right
in your own territory. G-E
Merchandise Distributors
are located at key points
all over the country. For
further information see the
G-E Merchandise Distributor nearest you or mail the
coupon for a G-E Conduit
Products Catalog.

General Electric Con	npany
Section C-186	
Appliance and Merc	handise Dept.
Bridgeport, Conn.	
Sirs: Please sen ucts Catalog, Pub. N	d me a G-E Conduit Prod- No. 53-1.
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Address	*******************************
City	State



Promised in 5 WEEKS SHIPPED ON

*Standard

IN A HURRY?

Aren't we all these days.

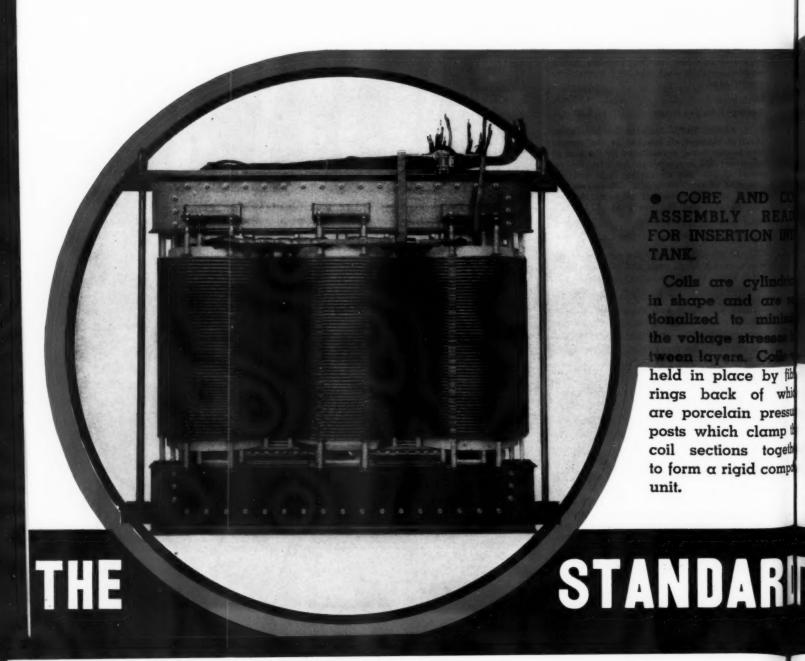
One of the largest engineering firms in the country recently found itself confronted with the job of expanding the facilities of a large Eastern Navy Yard almost two-fold. The job was to be accomplished in about one-third of the time ordinarily needed for this type of construction.

The most serious immediate problem was the lack of a power transformer to supply current for the construction work which had to be started at once.

TRANSFORMER

A telephone call put Standard's Boston Representative on the job immediately. He promised shipment in five weeks. The factory was notified of the urgency of the job. Things began to happen. The engineering department designed the complete job in a single day. Orders for materials were placed by telephone.

The transformer took form quickly. On exactly the promised day, five weeks later, a 5000 KVA, three phase, 60 cycle power transformer, rated 13,800 - 2400. volts, weighing 29 tons, was rolling east on a flat car to speed the National Defense Program.





READY FOR SHIPMENT Completed 5000 KVA, OISC power transformer three phase, 60 cycles, 13800—2400 volts. The Standard Transformer Company can supply you with the following types of transformers, in a hurry. Distribution & Power (oil and pyranol cooled), Dry Type, Instrument, Street Lighting, Special Type CALL US.

RIRANSFORMER COMPANY WARREN

lamp

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Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Licensing and the N.E.C.

Q. "The City has adopted the National Code as a standard of wiring and also provides that all contractors and journeymen be licensed.

"The questions are: Does the N.E.C. provide that the hanging (not wiring to, or connecting) of neon signs be done by an authorized electrician? Does the N.E.C. provide that a person removing and installing tubing on a sign be an authorized electrician? Does the N.E.C. provide that a person removing and installing transformer be an authorized electrician?"—W.L.R.

The provisions for licensing of electricians and the provisions as to what work may be performed by licensed parties will be found in your City Ordinance. The National Electrical Code does not contain any provision for the licensing of electricians or electrical contractors nor does it attempt to specify what work may or may not be installed by a licensed party. Such matters are not within the province of the National Electrical Code but should be defined by the local ordinance.

But where there is a local license law in effect, it is highly improbable that any electrical work on electric signs is exempted from its provision.

The only work on an electric sign which could or should be exempted is the painting of it.

Unpolarized Circuits

Q. "Given—A residential occupancy with a number of 2-wire unpolarized branch circuits, each circuit protected by a plug fuse in each conductor; this system being served by a 110-volt 2 wire overhead service derived from a 110/220 volt, 3-wire grounded neutral secondary wiring system of the Power Company which is grounded at



PINCH HITTER George W. Smith handles the Providence, R. I. affairs of Scannevin and Potter while J. W. Holloway spends a major part of his time at the firm's Newport office where they are doing a large electrical job at Uncle Sam's torpedo station.

the transformer but without grounding within the residence.

"Proposed—To install new service 110/220 volt 3-wire grounded neutral, using an outside meter socket and an approved entrance switch consisting of 60 amp. fused or unfused solid neutral main switch controlling 1-35 ampere 2 pole solid neutral fused switch for a range and the required number of lighting branch circuits, each branch circuit to be solid neutral with 1 fuse in other conductors. Service grounding to be installed as required by Code.

"Question—Can the existing unpolarized branch circuits be connected to this new switch and fuses without polarizing the entire existing installation or without using a fuse for both conductors? Code Reference—Section 2409-C.—C.T.B.

A. In a new polarized installation as now required, the following

requirements must be followed:—the grounding of the neutral conductor at the service entrance, the polarization of all sockets by connecting the grounded wire to the screw shell of all sockets, the fusing of the ungrounded wire only, and the connection of all single pole switches in only the ungrounded wire of the branch circuits.

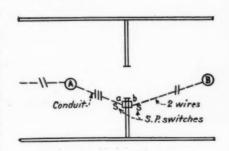
In considering how much of the above would have to be done to an old unpolarized, double fused installation in making extension to it and in order to use a grounded neutral, the Code decided to still require double fusing unless all sockets are polarized. It will permit the elimination of the fuse in the grounded conductor if the sockets are polarized. This was considered not to be a hardship as it is a very easy matter to simply reverse the connections at sockets where necessary.

The matter of switches and switch legs not being in the ungrounded conductor of the circuit was not considered serious enough to warrant action. Therefore the answer to this question is that the old unpolarized branch circuits can be supplied from the new 3 wire grounded neutral service provided that either the sockets be polarized or that double pole fusing be followed.

Switch Arrangement

Q. "Please let us know if there is any objection in the Code for the arrangement shown on the drawing.

"The point in question — would it be correct or accepted to feed the switch for light B through the switch of light A and run the neutral down to the switch boxes and up to the ceiling outlet B but without being interrupted, thus saving the conduit between the ceiling outlets?"—E.S.



The method shown is entirely correct. To control light at outlet A would require only two wires in the switch leg to switch S, but to feed on from switch S to switch S to control light B would require running the neutral from outlet A down to switch outlet S and then running it through (without interruption) to switch S and on to light B.



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CONSTRUCTION AND CHANGEOVERS

ith Porto-Power Pipe Benders

Toughest bending jobs like this are easy with Porto-Power. What's more, you can do 'em right on the job — smoothly, accurately and plenty fast. Dependable Porto-Power Pipe Benders handle diameter pipe and rigid conduit with big savings!

















BIG EXTRA UTILITY

The same hydraulic unit that does

the pipe bending accomplishes miracles on the many bend, press, lift, push, pull jobs which bob up

during electrical installations and

A Product of BLACKHAWK MFG. CO. Dept. P2061, Milwaukee, Wis.

ORLD'S LARGEST MANUFACTURER OF HYDRAULIC JACKS





ELECTRIC CONTROLS FOR EVERY PURPOSE FROM ONE SUPPLIER

N the Ward Leonard Line you will find the control that exactly meets your requirements and one that assures the dependable and maximum operation. Specific Bulletins available covering Motor Starters, Controllers and Speed Regulators large and small, Relays of various types and contact combinations, Resistors and Rheostats for every industrial service. Send for Bulletins of

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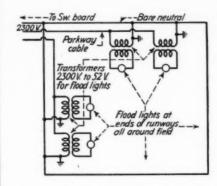
28 SOUTH STREET

MOUNT VERNON, N. Y.

Electric Control Devices Since 1892

An Outdoor Lighting Scheme

"Is there anything in the Code that would prevent the use of a bare neutral in an airport lighting system?"-C.P.R.



Article 300 requires that the conductors of wiring system have insulation. The only exceptions to this are found in 2304a, 3382 and Article 328. 2304a permits a bare neutral in the case of service conductors having a nominal voltage to ground of not more than 208 volts and where installed in an approved type of service cable or in rigid conduit.

Article 3382 permits the use of the bare neutral type of service-entrance cable for range circuits only or as feeders from a master service cabinet to supply other buildings, if the cable has a final non-metallic outer covering and if the supply current does not exceed 150 volts to ground.

Article 328 provides for the use of bare-conductor feeders within a building, but where the voltage between conductors does not exceed 600 volts.

As the suggested airport lighting plan does not come within the restrictions of these exceptions the Code does not recognize such a system of lighting.

Ungrounded Supply and Wiring Systems

"Our Inspector has ruled-"1. No interior wiring system shall be grounded unless there is at least one good ground on the secondary system by which it is supplied and if not grounded because of fact stated, all service conductors must be fused and the service switch must open all of them simultaneously.

2. No service conductor of an interior wiring system shall be metallically connected to a service cabinet when said interior wiring is ungrounded because

How to Boost Wiring Capacity Without Rewiring

OTHER AIDS FOR OVER-LOADED SYSTEMS



AIR-COOLED INDUCTION REGULATORS

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Over-loaded circuits mean low voltage and inefficient operation of motors and lamps. G-E air-cooled induction voltage regulators will bring performance back to standard. And indoor installations are easy to make—no vault is required. (Bulletin GES-2285)



PYRANOL TRANSFORMERS

An easy way to provide for new loads. Install them indoors at load centers to get power right where you want it. No vaults required. Close-to-the-load installations save secondary copper, give better voltage, and reduce losses. (Bulletin GEA-2048B)



AIR-COOLED TRANSFORMERS

Like Pyranol transformers, these units can be installed indoors to obtain greater capacity plus savings in both time and materials. Partic-ularly adapted to circuits 600 volts and below. (Bulletin GEA-897H)

IMPROVE POWER-FACTOR G-E PYRANOL

'You get

- A 10- to 40-per cent increase in circuit capacity depending on plant powerfactor)
- Savings up to 50 per cent over other mtehods
- Possible savings in power cost that may pay for the capacitors in one to three vears

Does your plant use induction motors? Induction furnaces? Then the chances

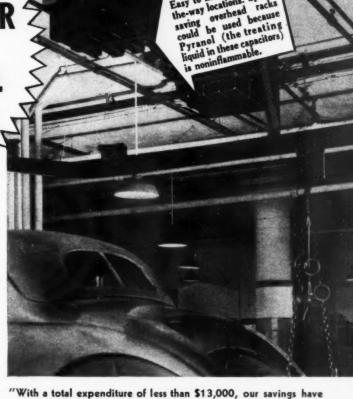
profitable experience of the Murray Corporation of America, Detroit, after increasing the capacity of the plant distribution system with 1440 kva of G-E Pyranol capacitors. are that the power-factor is low-that your circuits are

"clogged up" with a lot of reactive (nonworking) current. And that means that you can greatly increase the capacity of your existing wiring simply by installing G-E Pyranol capacitors on the lines. They neutralize reactive current and so permit the entire system to carry more useful current for additional motors and other equipment.

Equally important—if your power contract contains a power-factor-penalty or kva-demand clause, you will realize direct savings in reduced power cost that may pay for the capacitors in from one to three years. And the savings continue as a highly profitable return on the investment.

Ask your G-E representative for a quick estimate of the increase in capacity and the savings possible with Pyranol capacitors. Popular ratings are carried in stock for prompt delivery. We ship directly from the warehouse shelf.

Write for Bulletin GEA-77. General Electric, Schenectady, N. Y.



averaged \$1,000 monthly, which is better than expected. In addition, we have had no maintenance expense." This is the

GENERAL & ELECTRIC

Portrait of a Man **Hanging Up** a PROFIT ...



or why it will Pay You to Specify MITCHELL



Put yourself in this Fluorescent picture! MITCHELL fixtures are easier to sell, easier to install, surer to satisfy. Sell MITCHELL with confidence because you know your profits are protected . . . be-cause you know MITCHELL quality is just like a bond that protects your reputation.



You play safe when you install MITCH-ELL fixtures. They're designed better, engineered better, built better. Starting is swift, smooth, trouble-free. Installais swift, smooth, trouble-free. Installa-tion is easier. Maintenance is simple. And that means fewer returns, greater customer satisfaction, and plenty of repeat business!



MITCHELL offers you a complete Fluorescent line—a fixture for every Commercial and Industrial need. Send for Pocket Catalog No. 240 that shows you the most complete quality line of Fluorescent fixtures in the field . . . that helps you SELL!



MITCHELL is Better Fluorescent Lighting—and you can prove it! Only
MITCHELL fixtures carry this powerful
Triple-Label: (1) Fleur-o-lier Certification; (2) Underwriters' Approval; (3) MITCHELL's own complete Guarantee of Quality—a powerful 3-Way Guarantee that SELLS your customers!



MITCHELL Better Lighting means more repeat business—heartier handshakes from your customers! Don't risk your reputation or your customers' good-will by taking chances with inferior fixtures. It will pay you in the long run to specify and install MITCHELL quality Fluores-cent fixtures. They satisfy!



Model No. 2031. 200 WATT UNIT. Another new one! Uses four 40-wart, 48-inch lamps. Clear, ribbed diffusing glass panels; louvre bottom for greatest possible down-light. Satin-aluminum fin-ish; chip-proof white enamel re-flector. List Price, \$46.50.



[FROM PAGE 80]

of the fact that the secondary system by which it is supplied is also ungrounded, that is, a cabinet intended for grounded neutral with neutral terminal strap connected to the cabinet cannot be used.

"Please state whether these are correct. Other Inspectors disagree with him."—A.G.P.

The Code, requires that every exterior and interior wiring system of the types mentioned in the first paragraph above shall have a grounded conductor. The only "out" for such systems is found in the fourth and final sentence in section 2007 which says that, "Other unidentified ungrounded systems or circuits may be used only by special permission."

That is, if the inspection bureau having jurisdiction could be prevailed upon to approve any system which did not contain a grounded conductor such a system could be used but the inspection bureau would not have Code backing for its action. But if such was the case and there was no grounded conductor in the system, then every wire must be fused and no wire could be connected to the metal of any box or cabinet.

At the outset of our answer we assumed that we were dealing with a general a.c. system which, we have shown above, has to be grounded. The systems or circuits which do not have to be grounded and the National Electrical Code references are as follows:-

Section 2007. Two-wire branch circuits and multi-wire a.c. circuits tapped from the ungrounded conductors of circuits having identified neutrals. Normally for power with voltages between wires of around 208 or 220 volt.

Section 2512. Two-wire d.c. system of not over 300 volts to ground used to supply interior systems for industrial equipment.

Section 2512. Two-wire d.c. systems of over 300 volts to ground.

Section 2515. Electric furnace cir-

Section 2516. Circuits for electric cranes operating over combustible fibers in hazardous locations of Class III or Class IV. (Must not be grounded.)

Section 2517. Circuits of less than 50 volts unless supplied from systems or transformers of over 150 volts to ground, or unless supplied by transformers from ungrounded systems or unless the wires are run overhead outside of buildings.

Figuring Future Labor Costs

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[FROM PAGE 22]

of working hours is occasional, is often ignored by estimators except for the added wage rate. There is a definite slowing down under such conditions, however, and if a significant amount of work must be done after hours an additional 10 per cent should be added to the estimated overtime labor hours.

In the second classification, where overtime runs for many hours beyond the normal day, the lag in man efficiency is more marked and widely recognized. A factor of 1.25 applied to average labor units is usually necessary to cover the physical slow-down under such extended overtime.

Shift work adds another labor cost less generally recognized by estimators. But experience is comparatively rare and records differ. The following factors however, are conservative for electrical construction.

Evening shifts, from 4 to midnight show only a slight decline in man efficiency over regular day work, if lighting is adequate. A factor of 1.10 in average units is usually sufficient. The morning shift, from midnight to 8, shows a further decline requiring a factor of 1.15. A common practice on shifts is a lunch recess on company time which leaves $7\frac{1}{2}$ hours working time at 8 hours scale. This adds an additional 7 per cent to the above figures, making the factors:

Evening	shift.								1.17
Morning	shift.								1.22

The application of these factors to a job estimate is shown in table 2.

The labor hour corrections given here include no adjustment for higher wage rates that are inevitably coming as a result of labor scarcity. Good men are already rating a bonus of one to three dollars a day over the scale in some communities. It is impossible to accurately predict how far up the scale will go nor how much of a bonus key men will command. Some allowance must be made for this item, however, particularly if labor contracts come up for renewal during the life of the jobs.

Under the national defense emergency, material prices will not be allowed to run away. It is unlikely that wage scales will be permitted to rise out of reason. But the natural drop in average labor efficiency caused by the influx of men of uncertain skill into the craft is an equally important variable in estimating. Yet the cost is predictable to a large degree, and a careful analysis of future labor conditions will help reduce the amount of risk.

CRULUGS Baby elephant at birth, 200 pounds. Authority, Bronx Zoo, New York You may not be interested in hoisting elephants, but you do need lugs that hold tight - despite the high mechanical stresses and vibration to which they are often subjected in an electrical circuit. That's why we recommend "Burndy Scrulugs!" These inexpensive, quickly installed connectors support more than 4000 times their own weight in cable, laboratory tests show." Moreover, the patented Burndy design is strictly "Vibration Proof." Your circuit get real protection against loose connections - with Burndy Scrulugs. *KPA25 Scrulug, for 1/0 Stranded Cable, weighs 11/2 ounces, holds 400 pounds of cable. BURNDY ENGINEERING CO. INC. . 459 E. 133 STREET . NEW YORK CITY



Motor Shop Men Meet at Buffalo

Repair specialists study and exchange ideas on latest shop practices; discuss national defense—Bonnecaze is new president

The motor repair men held the eighth annual convention of the National Industrial Service Association, now renamed the National Electrical Service Association, at the Statler Hotel, Buffalo, May 19-21. The program was packed full of meaty subjects covering shop practice, administration and national defense.

Opening the theme of shop practice, were illustrated talks covering the experiences of two member companies. E. C. W. Johnson, Indianapolis, took the delegates on a trip through his new shop which features the elimination of central stockrooms. Frank Willey, Jr., described, in detail, a new modern small motor department in his shop, H. E. Grant, Nashville, related his shop experiences in rebuilding fractional horsepower motors.

Discussing test practices, J. E. Launder, Kansas City, gave a list of standard tests that shops might use to diagnose equipment troubles. W. J. Wheeler, New York, listed the equipment required and a recommended test procedure for service investigations for equipment manufacturers.

In this same general category, but on more of an engineering plane, were several papers covering the application and servicing of specific materials and equipment. Detailed discussions of the application of magnet wires of the Fiberglas-Insulated, Formwar and Nylon types were given by J. Paton, Essex Wire Corp., R. Hall, Phelps Dodge Copper Products Corp., and J. P. Davis and R. M. Hukle both of the Anaconda Wire & Cable Co. Illustrated case study analyses of radiant heat baking were offered by Howard Haynes, G. E. Co., and Paul Williams, Fostoria Pressed Steel Co.

Getting down to specific equipment application and servicing, A. M. Shong, Allis-Chalmers Mfg. Co., outlined a.c. generator voltage regulators, their application and servicing. F. L. Hanson, Ideal Electric & Mfg. Co., discussed plating generators and their troubles. Joseph Friedman, Wheeler Service, Inc., speaking on the subject of sleeve bearings for motors, offered a handy chart to facilitate estimating the cost of special bearings. Delving into the characteristics of the standard

motor, George M. Chute, G. E. Co., told how to apply these motors to special jobs.

The defense theme was keynoted by W. Davis, general manager, National Electrical Contractors Association, who pointed out the increasing seriousness of defense and suggested the cooperation of the motor shops in singling out their nondefense customers whose spare capacity could be diverted to defense needs. Rounding out this theme, G. K. Williams, Hamilton, Ontario, looked to our industry after the war and suggested a cooperative industry program to cope with post war conditions. Covering the subject of priorities, August Eckel, eastern editor, Electrical Contracting, gave a factual report of the immediate effect of the priorities and draft on shop purchases and men.

Along the administrative front, advertising and selling were discussed by Willian Balsam of the W. Balsam Agency and Joseph Ferrari both of Chicago. Frank Willey reported on the progress of the Certified Plan and Rewind Data

Bureau. He also submitted 19 lessons as outlined in the Apprentice Training Course. J. M. Pilmer, Des Moines, discussed the Rebuilt Equipment Exchange. J. R. Smith, Sorgel Electric Co., told how to increase sales and profits on air cooled transformers while W. H. Braunlich, Pittsburgh, reported on the labor cost survey of polyphase rewind jobs. S. F. High, Cincinnati, presented a uniform bookkeeping system for use in motor shops and J. E. Launder discussed a code of ethics.

At the business session, the convention voted to change the organization name to the National Electrical Service Association, since all of their work is with electrical equipment. New officers elected at this session were: President, L. Bonnecaze, New Orleans; vice-president, A. L. Brown, Worcester, Mass.; secretary, C. C. French, St. Louis, and treasurer, S. F. High, Cincinnati. W. H. Braunlich, Pittsburgh, and R. B. Glines, Lawrence, Mass., were elected to the Board of Directors for a two year term. Delegates elected to the Certification Board were F. W. Willey, Cincinnati; W. J. Wheeler, New York; C. A. Sievert, Chicago; A. Elson, Pawtucket, R. I.; and F. M. Mielke, Duluth.

A highly successful entertainment program was arranged to take care of the ladies. Joint entertainment included a dinner, banquet and a trip to Niagara Falls.

Manufacturers exhibiting their products at the convention included Acme Electric & Mfg. Co., Allen Bradley Co., The Allied Rubber & Mica Co., Allis-Chalmers Mfg. Co., Anaconda Wire & Cable Co., Baldor Electric Co., Buffalo Electric Co., Bussmann Mfg. Co., Cutler-Hammer, Inc., P. S. Du Pont, 3rd; Essex Wire Corp., Fostoria Pressed Steel Corp., Furnas Electric Co., General Electric Co., Helwig Co., Ideal Commutator Dresser Co., Johnson Bronze Co., Lima Armature Works, Martindale Electric Co., Mica Insulator Co., The Ohio Carbon Co., Owens-Corning Fiberglas Corp., Potter & Rayfield, Inc., Wagner Electric Corp. and Westinghouse.



"But Lady, you don't save any wire by using short circuits."

NEW WESTINGHOUSE INDUSTRIAL MULTI-BREAKER THE



The Westinghouse Industrial Multi-Breaker provides positive circuit protection at a new low cost.

With Bi-metal thermal-type overload protection, it eliminates needless service interruption, yet trips out when overload becomes dangerous or when short circuit occurs. It is fuseless; is quickmake, quick-break in operation; has an indicating handle that shows ON and OFF, an indicating target that shows TRIP.

Write Dept. 7-N, Westinghouse, East Pittsburgh, Pa., for complete information and prices.

J-21172





NOW AVAILABLE for any

single or three-phase normal-duty

amperes, 2 or 3 poles.

circuit, 230 volts a-c, 15 to 100

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[FROM PAGE 84]

NON-TAMPERABLE FUSE MANUFACTURERS FREE PATENTS

Steps have just been taken in an effort to clear the way for the adoption of a standard tamper-resisting, size limiting, fuse plug and fuse holder. This comes after several years delay because manufacturers of different types of so-called "non-tamperable" fuses could not agree on a standard.

The action comes from Bussman Manufacturing Company of St. Louis, makers of the well-known "Fustat". H. T. Bussman, vice president, in a letter to the Electrical Committee N.F.P.A. has offered to permit the manufacture of its Fustat and fuse holders by any manufacturer of plug fuses without royalty. The license agreement involves no cost or restriction other than that these fuses must be listed by the Underwriters' Laboratories. This proposal will be brought before the coming meeting of the Electrical Committee in Chicago on June 10 and 11.

Chase-Shawmut has advised the committee that it will release its patents for use by anybody should the Special Committee Report for Type S fuse be adopted or should "Tamres" fuse become the standard.

ELECTRICAL COMMITTEE TO REVIEW CODE OBJECTIVES

A special meeting of the Electrical Committee of the National Fire Protection Assn. will be held in Chicago June 10-11.

Several broad plans will be discussed including, 1) a five year interval between Code revisions, 2) abbreviated codes for use in areas where only one or two simple wiring systems are in common use and, 3) a special committee to study rules for temporary wiring and defense lighting.

A NECA proposal for interim revision to standardize wire types will also be dis-

Attendance will be limited to committee members and alternates and members of technical sub-committees.

DETROIT STAGES RECORD ELECTRICAL SHOW

Over 5,000 visitors attended the largest display of modern electrical materials and equipment for industrial use in recent Detroit history. The show was sponsored and staged by the Electrical Manufacturers Representatives Association of Detroit to show electrical contractors, engineers, architects, utility men, industrial plant engineers and purchasing agents the most modern materials available.

Official attendance figures were: 2,312—Industrial men 1,719—Electrical contractors

368—Utility men

435-Architects and engineers

281—Wholesalers men

Among the equipment displayed were industrial controllers, electronic controls, motors, tools, lighting equipment, panel-boards, circuit breakers, fuses, wires, conduit, tapes, wiring devices, boxes and fittings, service switches, transformers and several types of industrial power raceways and bus systems.

CHICAGO ADOPTS FLUORESCENT RULES

Special rules for wiring and installing fluorescent lighting fixtures have been issued by the Division of Electrical Inspection in Chicago. The regulations affect (1) the design and construction of fixtures, auxiliary enclosures and wiring space; (2) methods of installation and (3) wiring within the fixture and connections to the branch circuit.

The rules pertaining to installation and wiring follow:

Fixtures shall be installed and connected in a permanent manner.

Adjacent combustible material, shall not be subjected to temperatures in excess of 194 degrees.

No fluorescent lighting fixture whose temperature exceeds 120 degrees shall be placed over lighting outlet containing type.

R rubber covered conductors.
Fixtures employing more than one fluorescent tube lamp, mounted on wooden lath and plaster walls or ceilings, or a



CANDID SHOTS OF NESA MEETING AT BUFFALO—(1) Frank Willey, Jr. discusses shop layout with his dad Frank, Sr. of Willey-Wray Electric Co., Cincinnati. (2) Some shop men from Boston inspect an exhibit. (3) Jack Pilmer, Electric Engineering Construction Co., Des Moines, hobnohs with "Andy" Brown, A. L. Brown Associates, Worcester, Mass. (4) New president Leonce Bonnecaze, Best Electric Co., Inc., New Orleans has accepted the gavel from retiring president Carl Sievert, Sievert Electric Co., Chicago, while new vice-president "Andy" Brown looks on. (5) John Launder, Independent Electric Machinery Co., Kansas City; Selden High, Sullivan Electric Co., Cincinnati and Roland Glines, R. B. Glines Co., Lawrence, Mass., do some work. (6) Russel Raine, R. W. Raine Co., Miami, and Stanley Leen, Jr., Leen Electric Motor Service Co., Bangor, Me., greets J. A. Turner, Tampa Armature Works, Tampa.

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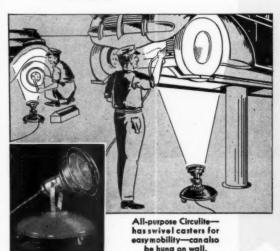


Above: One of many types of Steber Floodlights—Cat. No. 582.





Adjustable type Floodlight with telescoping standard and ground spike. Portable stand also available in place of spike.



PRODUCTS

MEAN QUICK PROFITS FOR YOU...

WIDELY used—reasonably priced for quick sales, the STEBER Line of Lighting Equipment has become an important profit line all over the country.

3 NEW

DISPLAY BOARDS

Three attractive new

"Self-Selling" Display Boards are now ready.

Write for our Bulletin

201 for illustrations and complete data.

STEBER Floodlights are available in open and enclosed types—for indoor and outdoor use—with practical mounting arrangements and stands to meet a wide variety of uses.

Industrial and Mercantile Uses

Night illumination is now used by industry as never before—lights are needed everywhere—yards, driveways, entrances, stock piles, loading

areas, etc. And the use of floodlights and color effects for display rooms, schools, night clubs, restaurants is still growing at a rapid pace—all of which means big volume sales with the STEBER line carried in your stock.

For Gardens, Night Games

In the cool of summer evenings,—lawn games, croquet, badminton, archery can be enjoyed—if the necessary illumination is provided. This is an important field for STEBER Lighting Equipment.

As evidence of the correctness of design and quality, the STEBER Uti-lites were the first complete floodlight line to be given approval by the Underwriters' Laboratories, Inc.

Our general catalog will give you all the data—let us mail you a copy...THE STEBER MFG. CO., 1020 West Adams Street, Chicago, Illinois.

STEBER LIGHTING EQUIPMENT

11

DON'T COMPROMISE With Safety Use PAINE **Expansion**

Solid Material



And Other Solid Materials

Malleable Shields



For Use In

BRICK

CONCRETE

 MARBLE STONE

And Other Solid Materials

SINGLE MACHINE **BOLT SHIELDS**



For Use In

CONCRETE

MARBLE

BRICK

STONE

And Other Solid Materials

Ask your Supply House Today for PAINE Lead Anchors and Write for Complete Catalog of Anchoring Devices.



2961 CARROLL AVE., CHICAGO, ILL.

New York Warehouse & Sales: 48 Warren St.

On the Hews

IFROM PAGE 861

ceiling or wall constructed of combustible material shall be provided with at least 2-in. air space between the fixture and the finished surface. (This paragraph does not apply to a single strip surface metal raceway).

Where recessed or partly recessed type fixtures are installed in non-fireproof and semi-fireproof buildings, all combustible materials within the recess must be fireproofed with 4-in. asbestos board unless fixtures are approved for this purpose.

Openings in the walls and ceilings shall

be framed with angle iron, a specially constructed frame or other means for secur-

ing the fixture enclosure. Where standard surface metal raceways are employed for housing fluorescent lighting, they will be approved for exposed work only, and not for recessed or partly recessed installations.

Resistors designed for direct current operation shall not be placed in any standard surface metal raceways measuring less than 3-in. wide and 14-in. deep.

Not more than 16 units nor more than 1,000 volt amperes shall be placed on any

single branch lighting circuit.

Fixture wire shall not be smaller than
No. 18 A.W.G. copper stranded, Type AF or CF.

The wire for recessed or partly re-cessed fixtures shall be carried from the fixture in flexible metallic conduit for a distance of not less than two feet and not more than six feet to a standard outlet or junction box which will be not more one foot away from the fixture. Such boxes when located in a hung ceil-

ing, will not be considered as concealed provided they are accessible when the fixture is removed.

Type R rubber covered conductors shall not be employed for wiring any type of fluorescent lighting fixtures.

The fixture shall not be used as a splic-

ing chamber for other circuits or a com-

mon raceway for other conductors.

No live parts shall be normally exposed within the fixture.

All splices or taps shall be soldered and covered with asbestos and friction tape, unless protected by approved insulated, solderless connectors.

In show or wall cases the use of ex-posed flexible cord or fixture wire shall not be employed. Auxiliaries, series reactors and resistors, when not a part of the fixture assembly may be enclosed in a separate metal cabinet provided it is suitably ventilated, installed in a permanent manner and accessible.

CERTIFICATION ON A.W. FRONTS

Certification activities continue on all fronts covered by the adequate wiring promotional programs. Here's what is being done at some of the local bureaus.

Indianapolis, Ind.—Approximately 100,000 people inspected three model homes that were certified for adequate wiring at recent 20th anniversary Indianapolis Home Show. The homes were constructed in the main arena of the Manufacturers' Building at the Indianapolis State fair grounds.

Warren, Ohio-The H. B. Miller Electric Company of Warren, installed the wiring in the first of a group of approximately twenty adequately wired homes to



WOLVERINE STATE electrical contractors gathered together in Muskegon, on shores of Lake Michigan, for their annual convention in April. They reviewed proposed state legislation, studied lighting, planned ways to strengthen the organization, talked shop and elected officers. New president is Arthur VanVliet, Detroit, (upper left); vice presidents, F. J. Groleau, Muskegon and W. G. Apps, Roseville, (upper right) and secretary H. B. Gelders, Grand Rapids, (lower left). Representing two local groups from Eastern Michigan were Joe Penn and Russell Kurth of the Thomas Edison Club, Chas. Capp and E. H. Lastar of the Steinmetz Club, (lower right). be constructed by J. J. Frankie, builder. Mr. Frankie recently received the first ade-

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Mr. Frankie recently received the first adequate wiring certificate to be issued by the Warren Adequate Wiring Bureau.

Manchester, N. H.—An adequately wired demonstration home was recently opened for inspection by the Public Service Company of New Hampshire. Smart Electric Company installed the wiring for Wilford Croteau of the New Hampshire Building and Construction Co. About 3,000 persons visited the home. visited the home.

visited the home.

San Mateo, Calif.—Four thousand small homes in the Hillsdale development of David D. Bohannon, San Francisco peninsula realtor, will have certified adequate wiring. The firm has adapted this as standard wiring for its homes.

San Jose, Calif.—Certified wiring of new homes and installation of major elec-

new homes and installation of major electrical appliances reached a new high in the San Jose Division of the Pacific Gas & Electric Co., which includes Santa Clara and San Mateo Counties. According to a recent sales department report, 263 new homes were certified for wiring during 1940, 180 were equipped with electric ranges and 103 with built-in type electric air heaters.

ROCKY MT. LEAGUE GETS NATIONAL AWARD

At a recent meeting of the Rocky Mountain Electrical League with the Denver Chapter, president G. B. Buck formally accepted for the League, the "Supreme Honor" award bestowed by the American Trade Association Executives. The award was made for "outstanding achievement and distinguished service rendered to the industry it represents, to commercial and industrial development and to the public,

during 1940."

The Certificate of Honor, presented by Secretary of Commerce Jesse H. Jones during Washington ceremonies, was won by the League in competition with hundreds of other trade organizations. Most of them were national associations, representing practically every class of business. The League was runner up to the American Trucking Association, with 49,000 members.

CONTRACTORS GET A.W. BONUSES

Electrical contractors in New Orleans will get bonuses for turning in certified A.W. jobs. This is one of the outstanding features of the new certified adequate wiring program for electrical contractors, organized by the Electrical Association of New Orleans. The program will run for six months from May 1 to October 31, 1941. The bonus plan has the support of both the New Orleans Public Service, Inc., and the Louisiana Power and Light Com-

Details of the plan were announced by J. P. Maguire of the New Orleans A.W. Committee at the Electrical Association's "Contractors' Night" meeting on May 5. Up to May 9, there were 66 jobs either certified or ready for certification, accord-

ing to Mr. Maguire.



CORPORATION 3505 WEST ADDISON STREET . CHICAGO

Improved In the Kews for greater usefulness



New Features for Popular 7000 **Guard Series**

Guards in every sense of the word . . . the new McGILL 7000 Series protects not only light bulb but all connections to it. Note in the illustration above the Watertight rubber socket and the rubber seal in the handle end . . . both of which prevent seepage of water and moisture to the interior. Connections, light bulbs, users . . . all THREE are protected by this new McGILL construction, every detail of which passes the rigid requirements of Underwriters' Laboratories. This guard can also be furnished with McGILL guard can also be furnished with McGILL composition socket if desired.

There's a size and type for every need . . . in industrial plants, garages, railroad work, etc. Write for complete details.

McGILL MANUFACTURING CO.

VALPARAISO, INDIANA

Electrical Division



[FROM PAGE 89]

MILWAUKEE ENGINEERS REVIEW MAINTENANCE COSTS

Routine maintenance of electrical equipment using planned preventive measures shows definite economies over repairs after trouble appears, W. A. Perry, Supt. of Electrical Department of the Inland Steel Co. told the Milwaukee Electrical Maintenance Engineers at a meeting in Milwaukee on May 3.

Planned preventive maintenance he said, was introduced in the electrical department two years ago and has already shown economies of from 12 to 38 percent on various types of equipment.

The meeting, which brought together 200 electrical maintenance engineers and their guests from the heavy industrial area of Southeast Wisconsin, was held in conjunction with a three day exhibit of industrial electrical equipment and materials.

CONTRACTOR INSTRUCTS EMPLOYEES ON A.W.

The Hutton-Jones Electric Company. electrical contractors of Warren, Ohio, recently held a dinner meeting for its employees. C. R. Hinkle, manager of the firm, took this opportunity to familiarize the employees with the purposes and accomplishments of the adequate wiring program and stressed the importance of allemployee participation in the plan.

G. C. Rubenson, secretary of the Warren A.W. Bureau, discussed the part that the wiremen would play in A.W. promotion.

COMING MEETINGS

New York State Association of Electrical Con-tractors & Dealers—Saranac Inn, Saranac N. Y., July 7-10.

National Electrical Contractors Association— Annual Convention, Rice Hotel, Houston. Texas, Oct. 6-8.

National Electrical Manufacturers Association
—Annual Meeting, Waldorf-Astoria Hotel
New York, N. Y., Oct. 27-31.

WESTERN PENNSYLVANIA LEAGUE APPOINTMENTS

The new Electric League of Western Pennsylvania, formerly known as the Electric League of Pittsburgh, has been deprived of its industrious manager, Gerard H. Nickerson, by the U. S. Armed forces. Mr. Nickerson, manager of the League for more than 11 years, was called into active service with the U. S. Navy on April 15.

To fill this vacancy, the Board of Directors at a recent meeting appointed W. D. Shaler, Duquesne Light Company, as Right at your Finger Tips

CARBON **BRUSHES**

Washer * Refrigerator Fan * Vacuum Cleaner and other small motors

> Specify "Superior" and you specify the exact fractional h.p. motor brushes for the job. Be right and save money
> — avoid troublesome performance.

All that the name implies

SUPERIOR



CARBON PRODUCTS, INC.

Profit by USING

Dependable Porcelain

OUTLET BOXES





* Glazed and unclazed styles conforming to all existing standards of demensions, spacing, pusi-tion of knockout holes, and mounting serews. High mechanical and electrical efficiency.

Contractors who use these products not only estab-lish themselves most securety with their customers but also build their business by making each job a true quality one. Send for builetin.

ILLINOIS ELECTRIC PORCELAIN CO. MACOMB, ILL.

acting manager for the duration of Mr. Nickerson's absence. Mr. Shaler was dealer contact man for the League from 1936 to 1939 and connected with the Sales Promotion Department of the light company since that time.

Another vacancy recently filled was that of secretary of the League. Frank A. Kolb, Duquesne Light Company, was elected to take over the duties of George A. Gardner who recently resigned that

position.

Under its new setup, the League now has a Contractors Division and an Electrical Maintenance Engineers Division, both of which are actively gaining in membership. H. E. Boedecker, Crucible Steel Company, is president of the maintenance group which now has a roster of more than 200 members.

REWIRING ADVANCED

Walter C. Heston has been appointed acting manager of the Northern California Electrical Bureau, the organization carrying on the drive in San Francisco bay region for the modernization and rewiring of commercial buildings. Major George W. Barker, the manager, was called to active duty at Santa Barbara. Heston, industrial engineer for the Bureau, did a large part of the economic analyses of building operating costs which were materially helpful in deciding managements of office buildings to rewire and relight. Contractors followed up these openings to do \$647,800 worth of work in a year and a half.

-WITH THE - facturers

Century Electric Appointments

Century Electric Company of St. Louis, Mo. announces the appointment of J. L. Woodress as director of sales. He is assistant secretary of the company and has been a member of the board of directors for a number of years.

Earl S. Moore becomes general sales manager. He joined the company in 1916 and became export manager in 1920.

C. E. White has been made export manager. He spent eleven years as foreign representative, both in England and on the continent. On his return in 1938 he was successively regional sales manager for the New York and St. Louis zones.

Weston Electrical Instrument Corporation has appointed Cowperthwait and Brodhead, 126 Newbury Street, Boston, Mass. as representatives to succeed the late James O. Murray. The new company will serve Weston in Massachusetts, Rhode Island, Maine, Vermont and New Hampshire.

LET'S PLUG IT IN

... Speedily!

Throwing the production capacity of this country into full swing—putting the country's mighty resources to work—PLUGGING IN the industrial machinery of the USA—that is today's big job.

It is a job that must be tackled with determination by every branch of the electrical industry.

To aid National Defense, Roebling has "plugged in" its facilities. Roebling plants are operating day and night—at full capacity.

Equally important, Roebling is unceasingly maintaining the high standard of quality for which Roebling electrical wires and cables are noted—a standard of quality that is a safeguard against shutdowns and delays, that assures all-around dependable service.

JOHN A. ROEBLING'S SONS COMPANY



ROEBLING
ELECTRICAL
WIRES AND CABLES

1941

In Quality and Service SO SAY THOUSANDS of SATISFIED USERS

Fluorescent Lamp Holders, Starters and Starter Sockets—recognized as tops by contractors and dealers who demand the best—backed by the approval of leading laboratories.

LLOYD Starter Socket

Bik. Cat. 252

Has unique "Lobster Claw" Dual Spring Lock. Insures a contact that can't shake loose. Pat. Pend.





LLOYD Lamp Holder with Starter Socket

Cat. 253-Black Lampholder

(Cat. 251) combined with Black Starter Socket (Cat. 252).

Cat. 253-W-White Lamp-holder (Cat. 251-W) com-bined with Black Starter Socket (Cat. 252).

Pats. Pond. Starter Not Included

LLOYD Lamp Holder

Cat. 251-Black Cat. 251-W-White

Lamp inserted by pushing straight into holder where it is lecked. Removed easily as indicated by arrow. Pat. Pend.



LLOYD STARTERS

Quick Starting - Longer Life - several times standard specifica-

FS-2 for 15 and 20-watt lamps. FS-4 for 30 and 40-watt lamps. Certified by Electrical Testing Laboratories

FS-6 for 100-watt lamps.

ate Starter Socket Remote Mounting

the famous Lloyd ster Claw" Dual Spring Cat. 382-Pat. Pend.



All Lloyd



Approved by Underwriters'

LLOYD Products Co.

Providence, Rhode Island Representatives in 22 Leading Cities



IFROM PAGE 911

The Fostoria Pressed Steel Corporation, Fostoria, Ohio, has acquired the exclusive manufacturing and sales rights from Dewey Thibault and Company, Boston, on the latter's infra-red process equipment designs. The Thibault trade name "EvenRay" is a part of the agreement and equipment made under this license will be branded "Fostoria EvenRay ParaSphere." The name "ParaSphere" ParaSphere." is the Fostoria basic trade-mark for its infra-red process line.

Hygrade Sylvania Corporation, Salem, Mass. has added William R. Rivers to its sales department, and put him in charge of the merchandising of special products manufactured by the Hygrade Lamp Division. Mr. Rivers was formerly a representative of the Accessories Equipment Section of General Electric Co., Bridgeport. Mr. Rivers will be located at 60 Boston Street, Salem, Mass.

S. H. Couch Company, Inc., North Quincy, Mass. announces that its New England salesman, Captain L. W. Oberacker has been called to Washington for active service in the Quartermasters Corps. During his absence, he will be replaced by W. L. Collins, who will take over this territory.

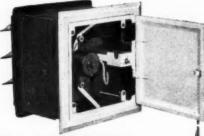
The Trumbull Electric Mfg. Co., Plainville, Conn. has appointed Lester C. Watson a special representative assigned to motor control sales. His headquarters are in the Boston office, Statler Building.

Wm. A. Edwards has been appointed a field representative of the Boston office. He is assigned to the southwestern New England territory. He was formerly connected with the sales and sales promotion departments at the Plainville factory.

Roller-Smith Company, Bethlehem, Pa. announces the appointment of W. R. Swoish as vice-president in charge of sales and James E. Bevan as vice-president in charge of manufacturing operations.

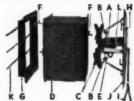
John A. Roebling's Sons Company, Trenton, N. J. announces the appointment of Robert T. Bowman as director of public relations.

Ohmite Manufacturing Company, Chicago has appointed Roy S. Laird sales manager. He has been with the company five years as sales engineer.



No. 1 KITCHEN **VENT FAN VALUE!**

With the new automatic lever-operated shutters, and other important features, this Signal Kitchen Wall Box Vent Fan, for permanent installation, to fit walls 6" to 24" is today's No. 1 Kitchen Vent Fan value. \$21.50 list price for walls 6" to 11½". Can be installed in new or old homes. Send for details.



shutters. L—larg

SIGNAL ELECTRIC MFG. CO.

MENOMINEE, MICHIGAN Offices in all principal cities



are easy to sell as they are in demand for all kinds of buildings and are specified by leading Architects and United States Government. OVER THIRTY YEARS' EXPERIENCE



More Gossip -

Wants More Light

Thomas Martin, city electrician, Vancouver, B. C., is in there pitching for better lighting on the city's bridges. He recommends replacing present 200 candle-power lamps with 600 candlepower units at a 25-ft. mounting height.

Utility Warns Against Peddlers

The Rochester, Minn., Electric Department, a municipal utility, sent out a warning in April to commercial customers against high pressure sales crews from out of town selling fluorescent lighting.

The peddlers promise vast savings in light bills and often get a fancy price for poor equipment. The utility asks its customers to be skeptical of exaggerated claims and to consult local contractors and dealers for the facts.

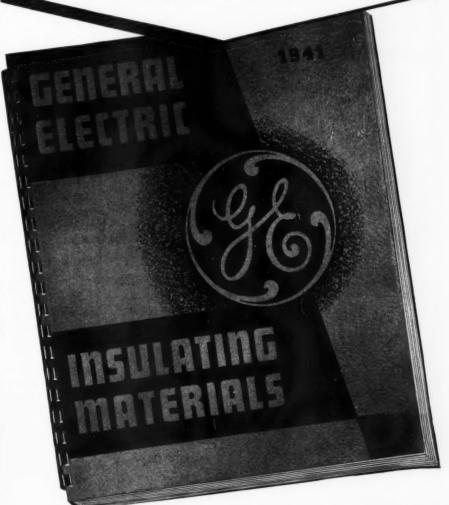
Appliance Hospital

Hospitalization of electrical appliances will be cheerfully taken care of by A. V. Ablett and D. C. Hubbard, who have recently begun business in Kelowna, B. C. under the firm name of Electrical Appliances Hospital.



GOING PLACES: C. Allan Harlan organized the Harlan Electric Company of Detroit in January, now has several blue chip industrial jobs totaling a half million dollars. Combining shrewd and forceful salesmanship with a genius for electrical design, Harlan likes the tough ones; laboratory wiring, interlocked power, low loss feeders and such. The rolling scaffold is his own design; used for installing miles of heavy bus on a recent job in record time. Impatient with slow hand methods, he uses elaborate power tools and electric welding wherever possible, constantly working out new production methods.

A NEW CATALOG FOR YOU



The NEW G-E INSULATING MATERIALS CATALOG

Is Now Available

Crammed with pictures, descriptions, tables, specifications, etc., it consists of an up-to-the-minute listing of General Electric's complete line of outstanding Insulating Materials.

outstanding Insulating Materials.

This catalog will be of real help to you when you are planning purchases for installation, repair, and maintenance supplies.

GET YOUR FREE COPY NOW!

Just Use This Coupon We'll Hurry Your Copy To You

Section M-186, Appliance & Merchandise Department, General Electric Co., Bridgeport, Conn.

Send me a copy of the NEW G-E IN-SULATING MATERIALS CATALOG right away!

Name.

Address

City...

GENERAL % ELECTRIC

FLOOR BOXES and WIRING SPECIALTIES

NO 251-R ADJUSTABLE GANG FLOOR BOX



NO. 252-R TWO GANG BOX

Two gang adjustable floor box with No. 208 receptacle in one section.

One cover plate with 1/2" flush brass plug and the other cover with 2 flush brass plug.



NO. 110 NON-ADJUSTABLE WATERTIGHT FLOOR BOX



Cutaway view shows how tapered unit receptacle fits tapered opening in top of box body. The latest in design, appearance, and simplicity of installation.

• The Latrobe Line is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties

Write for details TODAY! **FULLMAN MFG. CO.** PENNA.

More Gossif

Phantom Kitchen

The wiring, wheels and works behind a modern kitchen were shown in a unique display set up by the Milwaukee Electric League at the Milwaukee Home Show in March. Wire outlines of refrigerator, sink, range and cabinets exposed working parts. Electric wiring was neon tubingto show the kitchen as it appears to the experienced eye of the electrician," said B. H. Barg, chairman of the League's adequate wiring committee.



INVENTORY CHECK-UP is discussed by Walter Mitschke (left) chief stock clerk and Earl W. Budlong, engineer in charge of electrical construction, at the R. I. Earl is having a tough time getting men and material to keep his jobs running on schedule.

Data Library

Labor cost data manuals and original labor cost material extending back over thirty years have been collected together by Wm. Grace Sr. of the Grace Engineering Company, Dallas. Early records are complete even to detailed diagrams accompanying the time reports.

Peddlers Controlled

Waterbury, Conn., has a peddlers law that has been used to control hit and run fluorescent unit salesmen. They must take out a license unless they maintain a local warehouse stock or work for a recognized manufacturer.

After Defense

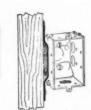
Mark Wright, of Wright Bros. Electric Company, San Antonio, has shied off from the camp wiring that has been turning all Texas on its ear. It is all so big the head man must stay in charge. Wright says he has been in business 30 years-and wants to be there when the war is over.

AUSTIN UNIVERSAL BOX BRACKET



This mounting bracket is easily and quickly attached to any standard Switch Box having 9/64' nail holes in the sides spaced on 1-1/16' centers. This appears to be standard with all leading box manufacturers so that you can now make up your own bracket switch boxes.

own bracket switch boxes. Equipped with two self-threading screws that center into the nail holes in the side of the box and a few turns with a screw driver holds it rigidly in place. The bracket is nailed to the side of the studding so that the surfacing material such as plaster board, lies flat against the studding.



nd for a free

THE M. B. AUSTIN COMPANY 116 S. Desplaines St. Chicago, III.

... the improved heavy duty conduit fittings. Standard and **Explosion-proof types**

Find out about the many advantages of Pylets: they save time and labor, help you get a better wiring job.



Pylet with Midget Triploc plug and receptack

PLUGS AND RECEPTACLES VAPORTIGHT FIXTURES FLOODLIGHT PROJECTORS AIRPORT LIGHTING EQUIPMENT

Write for bulletins

THE PYLE-NATIONAL COMPANY

1344 North Kostner Avenue CHICAGO, ILLINOIS

More Gossip -

Study Railway Control

Electrical Maintenance Engineers of Chicago were guests of the Chicago & Northwestern Railroad for their regular April meeting. High spot of the visit to the shops was inspection and demonstration of automatic train control and the electrical features of a modern diesel powered streamlined train.

Priority Trouble

Howard Miller, head of Utilities Engineering Co., Philadelphia has already bumped into priority trouble. He had some cable coming for a plant substation. The government grabbed it. He had to wait for a new lot to be manufactured. But there you are. The Government is a big guy.

cealed by rectangular ribbed glass secured by

old gold leaves. Fixture finished in off white with old gold trim. Old gold filagree over plastic illuminates

the ends. Takes three

18" 15-watt lamps. Length 23" — width 19½" — height with 2-

stem hanger and canopy 16". Suspension and

surface types.

His Own Tools

John S. Buchanan of Philadelphia makes a bit of profit by thinking as well as working. For example, he recently planned and built a special busbar bender and a copper saw to fit local conditions on a change-over job in the Drexel Building. They cut his costs.

Consultants

Members of the Street and Highway Lighting Committee of the Rocky Mountain Electrical League have been called into consultation in eight towns and cities in New Mexico, Wyoming and Colorado. They are bound and determined to bring the Great White Way into their own back yards.



DEARBORN CHAPTER officers of the Thomas Edison Club take time off at the recent convention of the Wolverine Electrical Contractors Association in Muskegon, Mich. to talk over some of the details of proposed state legislation discussed at the meeting. Left to right, Russell Kurth, Dearborn, vice-president; Lloyd Green, Inkster, president and Wm. Statzer, Lincoln Park, treasurer.



We offer Fluorescent Fixtures that are designed with great efficiency to give the long desired abundance of cool light at low cost—fixtures for homes, offices, shops, show windows, show cases, show rooms—all highly decorative, modern, graceful and that will blend with any interior. This is one of the few lines that is wholly complete.

Send for Descriptive Circular

LIGHTING PRODUCTS INCORPORATED
HIGHLAND PARK
ILLINOIS

Good Buildings Deserve Adequate Wiring

Many buildings today are not as profitable as they ought to be but they still are good buildings. Many of them are only a few years old. They became less attractive to tenants because they could not meet our modern demands for electrical current. When these buildings were built provision was not made for larger conduits and more conductors.

Investigate the possibilities of rewiring such buildings with small diameter building wire. The building owner will thank you for bringing the matter to his attention and you will make money.

The proper type and size of small diameter building wire is, of course, up to you to decide, but your best bet is Simplex-LATOX Type RU.

Sample cards and further information on this type of insulation will be sent on request.

SIMPLEX WIRE & CABLE CO.

79 Sidney St., Cambridge, Mass.



Fluorescent Fixture

A new fluorescent fixture of the direct, semi-indirect type for commercial applications. It is known as No. 3115 and is a new de ign which gives a balanced distribution of light on the horizontal as well as the vertical plane. Indirect component of light is produced by a modified V-shaped metal reflector. Direct glare of lamps is reduced by louvers in the bottom of the fixture. Units available for four or six 48-inch, 40-watt lamps; either ceiling or suspension mounting; wired or unwired. Units are equipped with high power factor ballasts, removable glow-type switches and starting compensators. Units are for ac operation only. Faries Manufacturing Company, Decatur, Ill.



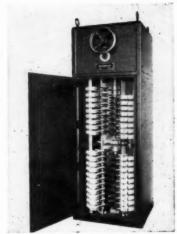
FARIES FLUORESCENT FIXTURE

Transformers

A new line of outdoor current transformers, embodying the Spirakore design, has been developed. Transformers are rated 23- and 34.5-kv. Weight of new units has been reduced 10 per cent in 23-kv. rating and 16 per cent in 34.5-kv. rating. Both units are three inches smaller in diameter. Units are designated Type KF-311 in 23-kv. and KF-316 in 34.5-kv. They are of porcelain-shell construction, filled with non-inflammable, non-sludging Pyranol, unless oil is desired. General Electric Co., Schenectady, N. Y.



G-E INSTRUMENT TRANSFORMER



WESTINGHOUSE SECONDARY CONTROLLER

Secondary Controller

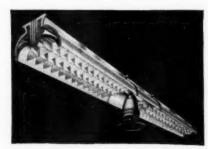
A new motor operated secondary controller has been developed for use with polyphase wound-rotor motors on fan, pump and similar drives. It provides either 13 or 20 balanced points of control by varying external resistance in motor Unit has secondary winding. camactuated contactors arranged for sequential operation in pairs from common motordriven cam shaft. Individual cams give "quick-make" and "quick-break" contact Separate copper arcing contacts action. prevent burning or pitting of main contact surfaces. Over-travel protection is provided by auxiliary cam-actuated switches. Motor may be supplied for 115 or 230 volts d.c. and 110, 220 or 440 volts, a.c. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WIREMOLD BOX UNIT

Box Unit

A new box unit for large tu-lamp fluorescent ballasts. It contains ballast, wiring and is designed to permit easy installation of large cross-section tu-lamp ballasts in conjunction with Wiremold No. 3000 fluorescent lighting channel and fittings. The Wiremold Company, Hartford, Conn.



GUTH FLUORESCENT LUMINAIRE

Lighting and Fan Unit

A combination fluorescent lighting and fan unit has been developed. It is claimed that the Guthfan draws the 7-deg. to 10-deg. cooler air from lower part of room and distributes it downward (at 45-deg. angle) without disturbing hot ceiling air or creating drafts that would decrease efficiency of fluorescent lamps. Combination includes 48-in. luminaires for fluorescent lamps and 18-in. extension sections for fan. Unit may be ceiling mounted or suspended from hangers. Extension lengths for additional lighting and cooling capacity are also available. Edwin F. Guth Co., 2615 Washington St., St. Louis, Mo.



SQUARE D RAINTIGHT SERVICE EQUIPMENT

Service Equipment

This line of raintight service equipment has been extended to meet requirements of Section 380, Article 3804, N.E.C. Enclosures have water-tight tops with lap joints which exclude moisture. over-lapping flanges on cover, guard against driving rain or jets of water. All knockouts are located below lowest live parts; a drip hole in bottom prevents accumulation of moisture. Standard fusebreaks act as switches and fuse carriers. All neutrals are grounded and provided with four 60-ampere and four 30-ampere connectors. The line includes 60-ampere main and range switches with either 0, 2 or 4 plug fusible lighting circuits. Parallel or multiple bussing of main and range fuse-breaks is available. Line side is equipped with 100-ampere solderless connectors and 60-ampere on load side. Square D Company, 6060 Rivard St., Detroit, Mich.





Contractors Ful-

Modern Porcelain Protected Wiring System for Adequate Wiring

This American modern way of life requires that our home living space be adequately convenient and comfortable electrically. It also requires that ample carrying capacity be provided for the electrical energy which makes possible the comfort it demands. This means more branch circuits, larger copper wires, and plenty of properly located convenience outlets.

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side.

All this can readily be supplied with Modern Porcelain Protected Wiring. The contractor easily visualizes the safety - providing possibilities of this really modern type of wiring.

Every requirement of an adequate wiring program can be met with a Modern Porcelain Protected Wiring System.

1. Sufficiently large copper wire for every branch circuit.

- 2. Required number of branch circuits to distribute loads.
- 3. Plenty of conveniently placed outlets.
- 4. Proper conductor sizes to the lighting units to provide ample illumination.
- 5. Wiring to every location where light will serve for comfort, convenience and protection.

Modern Porcelain Protected Wiring Systems provide adequacy plus, because the conductors are able to carry greater loads due to extra current carrying capacity of the wires in open air. As an example, a building wired according to National Adequate Wiring Standards with a Modern Porcelain Protected System will be able to meet future load increases better than any other wiring method because of its reserve or extra carrying capacity.

A Modern Porcelain Protected ADVERTISEMENT

Wiring System represents a completely adequatemeans of safety, for along with the comfort, convenience, economy, and efficiency it affords, it also provides a satisfying sense of protection.

Electrical porcelainmaterials for Modern Porcelain Protected Wiring Systems are manufactured by

Illinois Electric Porcelain Company, Macomb, Ill.

Knox Porcelain Corporation, Knoxville, Tenn.

Porcelain Products, Incorporated, Findiny, Ohio

and may be obtained through your electrical wholesaler.







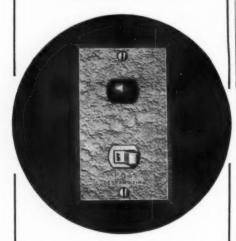








P&S-Despard PILOT LIGHT COMBINATIONS



Cat. Nos. 1377 and 1411 with 1881-B plate

NOW a P&S-Despard FLUSH PILOT LIGHT which may be installed in combination with any P&S-Despard switch or receptacle in a single gang.

Cat. No. 1377 is supplied complete with 6 Watt, 120 Volt Lamp and red jewel.

Sold Through Electrical Wholesalers

Catalog on Request

Pass & Seymour, Inc. SYRACUSE, N. Y.



[FROM PAGE 96]

Solenoid Starter

A new Size 4, Bulletin 709 solenoid starter has been developed. This new unit, which has a maximum horsepower rating of 50 hp., 220-volts and 100 hp., 440-550-600 volts, will replace the older Bulletin 710, Size 4 clapper starter. Double break, cadmium silver contacts are encased in an arc hood, each pole of switch having its individual arc chamber. Starters can be closely grouped without danger of flash-over between switches. Starter is mounted on self-insulated metal base plate, which may be mounted on any metal surface without extra insulation. It can be provided with or without an en-closure. Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis.



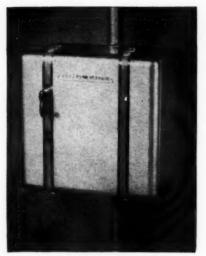
ALLEN-BRADLEY STARTER

Troffer System

This troffer system combines fluorescent lamp and a special inverted lighting trough set flush in suspended ceiling construction. Troffer equipment may be recessed in sound absorbing or plaster ceiling surfaces and is available in individual unit lamp lengths or continuous rows. It may be worked into general pattern of ceiling. Troffer spacings depend upon room dimensions, ceiling and wall finishes and additional illuminating factors. Louvers are easily removable for relamping. Equipment wired for 60-cycle, 110/125-volt a.c. Also available for 199/216 and 220/250-Separate replaceable starter switches included. Ballasts and compensators located in wiring channel. Hub Electric Co., 2221 W. Grand Ave., Chicago, Ill.



HUB TROFFER SYSTEM



G-E ENCLOSING CASE

Enclosing Case

A new enclosing case has been designed for Type AE-1 air circuit breakers in interrupting ratings of 15,000 and 20,000 amperes. New mounting facilities are provided in case. It is recommended for use in industrial plants and office buildings for protection of lighting and power circuits against damage resulting from excessive overcurrents or short circuits. It completely encloses breaker unit, making it Cover is secured by four dustproof. trunk-type latches, which can be padlocked to prevent tampering. Case is bolted to wall and cables are connected to solderless terminals inside. Breaker unit is placed on brackets in case and it will pivot into connected position with its finger contacts engaging stationary studs in case. Breaker is then bolted in place and case cover and handle are put on. Type AE-1A breaker is rated 15-225 amp.; 600 volts a.c., 250 volts d.c. and has a 15,000-ampere interrupting rating. Type AE-1B is rated 15-600 amp.; 600 volts a.c., 250 volts d.c., with a 25,000-ampere interrupting rating. General Electric Co., Schenectady, N. Y.



HYGRADE INDUSTRIAL UNIT

Fluorescent Unit

The F-235 fluorescent unit is designed for use in industrial plants. It uses two 100-watt fluorescent lamps. It permits wider spacing and is recommended for mounting near ceiling in high-studded areas. Reflector is easily demountable. Working parts are carried in housing. Mirastats are so located that starters can be removed or replaced without moving lamps. Unit is completely wired and assembled; corrected for power factor; equipped with Dua-Lamp auxiliary; and approved by Underwriters' Laboratories. Hygrade Sylvania Corporation, Ipswich, Mass.

Capacitor Plugs

For use in connection with the feeder distribution system, a new capacitor Flex-A-Plug has been developed. It consists of a fusible heavy duty switch or type "A" circuit breaker in combination with a G-E Pyranol filled capacitor. Plug may be utilized to improve power factor of a system or if overload condition exists reduces current to within safe limits. Discharge resistors are built into each capacitor unit. Also plugs may be equipped with Neon lights which by going out would indicate a ground on any one particular phase. Available in 230- and 575-volts. Trumbull Electric Mfg. Co., Plainville, Conn.



TRUMBULL CAPACITOR FLEX-A-PLUG

Wall Protector

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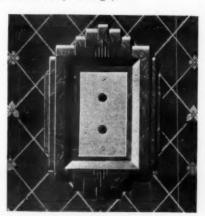
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ich.

These new plastic Protect-o-shields are available with switch plates to match. The wall protectors are molded of colored plastic to harmoniously compliment any color wall paper. The brass switch plate is removed and either replaced with plastic switch plate to match the wall shield being installed, or screwed back into position after wall shield has been placed under it. Shield is held in place by switch plate. Available in single and double gang sizes. Switch plates also available in new luminous plastic, which shows in the dark. Gits Molding Corporation, 4600 Huron Street, Chicago, Ill.



GITS PLASTIC PROTECT-O-SHIELD



Typical Smithcraft Troffer Installation in Accoustical Tile Ceiling of the NATIONAL CASH REGISTER COMPANY BOSTON, MASSACHUSETTS

Architect
Parsons & Wait, Boston
Electrical Distributor
Henry L. Wolfers, Boston
Electrical Contractor
A. J. Wolfe Company, Boston



SMITHCRAFT Fluorescent Lighting "TROFFERS"

Patent Applied For

Smithcraft Troffer Lighting is a Continuous System of Recessed Fluorescent Lighting in which the Troffer Units are connected end to end by the simplified, exclusive type of Smithcraft Connection, and installation is completed by the unique Smithcraft snap-in method which eliminates the use of bolts or screws.

Complete installation is flush with the ceiling and may be open-faced or covered by any desired type of light diffusing glass, but in either case no bolts or screws mar the surface appearance.

Architect, Property Owners and Electrical Contractors, prefer Smithcraft Recessed Troffer Lighting for its many advantageous, economical features. Smithcraft Troffer Units are shipped completely wired—ready to install.

Write for name of your nearest Smithcraft Distributor and more complete details on Smithcraft Troffer Lighting Units.

A. L. SMITH IRON COMPANY

235 EVERETT AVENUE

CHELSEA

MASSACHUSETTS

MINERALLAC HANGER



Conduit 3/8"—21/2"
Cable to 21/8" (with Bushings)

Cadmium and Everdur MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing to I1/4" conduit.

See your Jobber

New York City Office Theodore B. Dally 50 Church Street

MINERALLAC ELECTRIC CO. 25 N. Peoria St., CHICAGO

EVERY BATHROOM NEEDS THIS Extra HEAT



You need this bathroom heat every day in the year. When it's too warm for unit heat or too cold for unit heat alone—Thermador Built-In Bathroom Heaters are the answer. Just a flip of the switch and you are instantly blanketed in flame-less, fumeless electric warmth.

less, fumeless electric warmth.

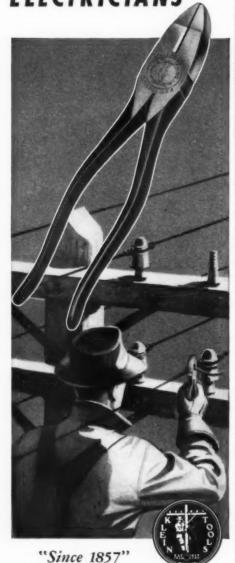
BATHROOM HEATERS

THERMADOR ELECTRICAL MFG CO. 5119 So. Riverside Dr., Dept. EC Los Angeles, California

Gentlemen
Please send me complete contractors
specifications and prices.

Name_____Street_____State_____

KLEIN . . . EQUIPMENT NEWS STANDARD WITH ELECTRICIANS



No "pretty good" plier is good enough for the man who has to work with them every day. That's why electricianseverywhere-rely on Klein Pliers. They know that each pair must pass an individual test far in excess to any service in the field. They know, too, that every pair is in-

dividually fitted, tempered and adjusted-that Klein Pliers have been the standard-"since 1857."

Your copy of the Klein Pocket Tool Guide will be sent on request.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributors

International Standard Electric Corp., New York





[FROM PAGE 99]

Lighting System

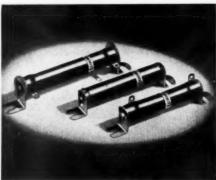
This new fluorescent lighting system is known as "Lite-Line" System. Units use 48-in, mazda fluorescent lamps and available in single and double reflector lengths. May be joined together in series to form continuous fixture of any desired length. May be installed on ceiling or suspended from ceiling to required mounting level for either general or localized lighting. May also be installed in multiple rows to form unbroken lines of light. Changeover from twin lamp to triple lamp operation can be effected when two lamp units are purchased with triple lamp reflectors. Benjamin Electric Mfg. Co., Des Plaines,



BENJAMIN FLUORESCENT LIGHTING SYSTEM

Resistors

These wire-wound vitreous-enameled resistors are available in "live" and "dead" bracket types for special applications. "Live" bracket type have flexible leads connected to tin-plated brass brackets. They are designed for mounting and making electrical connection by bolting slotted bracket type are mounted by bolting to brackets. Electrical connections are made separately to lugs. Brackets for one, two or three resistors are mounted to resistors by means of through-bolts. Both types of resistors are used for signal circuits, electrical refrigeration controls, storage battery charging, switchboards and other applications. Available in wide range of core sizes with diameters from 9/16-in. to 21in. Ohmite Manufacturing Co., 4835 Flournoy Street, Chicago, Ill.



OHMITE RESISTORS



Ask for Your Copy . . .

Here's the combined manual and catalog on motor capacitors.

Just the practical data you need in servicing capacitor-start refrig-erators—diagrams, charts, formulae, plus complete handy listings of all standard capacitor-start motors and their capacitor requirements. Handy cross-index of Aerovox capacitors and motor manufacturers' parts numbers. • Simply ask your job-ber for α copy. Or write us direct.



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Model PL-2 and PL-3 — Supplied with 16 volt 2 coil mechanism and transformer. Mounting space, Carriage Design — 42" long by 9½" wide.

Sell them for their beauty ... install them for service!

Model PL-12 and PL-13 — Supplied with 10 volt plied with 10 von mechanism less transformer. Op-erates through 400 feet of an-nunciator wire. Mounting space — 46" long x 7½" wide for



Here are chimes to fit the times . . . new, beautiful wall decorations. easy to sell, a pleasure to install.

Porcelain covers, with hand painted colors fired in, add distinction and sales appeal. Qualify mechanism, plus pleasantly toned chime tubes, add to its value. Sell them for beauty, intellight home for acroice. Write us for details on all types of LIBERTY chimes.

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"IDEALITE" meets the demand for a serviceable fluorescent unit low in first cost. Very efficient—easy to clean. Knockouts in back of wiring trough and each end for chain loops or stem suspension.



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BADGER

Synchronous
ELECTRIC TIME SWITCHES



CONTRACTORS LIKE THEM BECAUSE: they are dependable and easy to install

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of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY 1937 MEAD STREET RACINE, WISCONSIN

Ventilator

This roof ventilator, model "R", has been designed for flat roof installations. Unit consists of high capacity fan assembly enclosed in weather-proof penthouse of heavy galvanized iron and automatic vertical shutters. It can be flashed directly to roof slab as flanges are provided. Available in three sizes having capacities of 7,500, 11,500 and 16,500 CFM respectively. Shutter vanes are held open by spring and lever arrangement as long as fan is in operation. Viking Air Conditioning Corporation, 9500 Richmond Ave., S. E., Cleveland, Ohio.



VIKING ROOF VENTILATOR

All-Glass Tape

A new fibre glass adhesive tape, with a pressure-sensitive coating, has been perfected. The woven glass textile backing is the same one developed in recent years by the glass companies. The new tape will have a number of uses in the electrical industry. It is manufactured in rolls in full width of 40 inches and then cut into any desired widths, as paper-backed and cloth-backed tapes are cut. Industrial Tape Corporation, New Brunswick, N. J.



WABASH TUBULAR LAMP

Tubular Lamp

A new "sealed-silver" tubular lamp for use in tight corners has been developed. It fits into a T6½ tubular bulb that is ¾- or 1-in. in diameter and 5-inches long. It has built-in reflector in form of pure silver lining hermetically sealed inside bulb. It has a special "coil-coil" filament, coiled once and then recoiled over its entire length. Three metal supports anchor filament in place and protect it against vibration hazards. It comes in 15-, 25- and 40-watt sizes. Wabash Appliance Corporation, 335 Carroll St., Brooklyn, New York.

Service Connectors



LARGEST VARIETY of types, and a COMPLETE range of sizes. For all kinds of conductors.

conductors.

Popular connector at left is carried in stock in ALL sizes, up to 1,000,000 CM. Furnished with or without retainer.

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ANY MATE-RIAL — Hardware Bronze, Silicon Bronze, Aluminum.

MILLIONS IN USE and never one rejection due to performance or workmanship. Can be re-used over and over.

MADE IN OUR OWN PLANT under engineering supervision. Bodies and nuts precision machine-threaded for perfect fit. No sharp edges.

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EQUIPMENT NEWS

[FROM PAGE 101]

Attic Fan

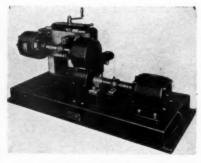
A new attic fan has been developed, called Type O Home-Cooling Fan. Some of the features are-all moving parts cradled in sound-absorbing springs, eliminating vibration noise; welded steel frame; eight steel blades, individually mounted and easily replaced in event of damage; deep inlet; reducing air noise and increasing fan efficiency; when equipped with reversible motor, fan will blow in or exhaust at will; ball bearings in fan hub permit operation in any position when equipped with ball bearing motor. Made in seven different sizes with various motor sizes for each, with capacities ranging from 6,200 to 30,000 cfm. Also available as a twin unit, with two fans in one frame operated by one motor. American Coolair Corporation, Jacksonville, Fla.



AMERICAN COOLAIR ATTIC FAN

Wire Stripper

This wire stripper is designed for heavy duty, continuous production operation in removing insulation from large coils, in stripping all shapes and sizes of heavy wire. Stripping is by two revolving wire brushes, each directly connected to motor by ball bearing arbor. One motor is movable to allow adjustment of brushes for various types of work. Motors are each ½ hp., 220-volt, 60 cycle, 3-phase, fully enclosed and fan cooled. Arbors are 1-in. in diameter at brush end. A special stop to regulate length of strip can also be supplied. The Wire Stripper Co., 1724 Eastham Ave., E. Cleveland, Ohio.



SPEEDCRAFT WIRE STRIPPER







PENN-UNION TEE CONNECTOR

Connector

This new hinged tee connector claims to give speed with permanence. Hinged clamp simplifies installation, as connections to main and branch are made independently. Throw the hinged clamp over the main and tighten screws, then branch can be connected afterward, at any time. Split-cone contact unit gives permanent grip on branch, which will not loosen under vibration. A tapered cone, made flexible by slots, clamps tightly onto branch when compressed by nut. Fitting may be re-used over and over again. It is made in a complete range of sizes, for one or more branch conductors. Penn-Union Electric Corporation, Erie, Pa.



IDEAL WELD-MASTE

Arc Welder

This new a.c. electric arc welder is known as the "Weld-Master". Design includes a reactance winding on separate core in addition to transformer. Reactance winding acts as a stabilizer. Fifteen different welding heats between 20 and 175 amperes give operator accurate heat and penetration control for each job. Penetration may be up to 4-in. or more if desired. Heats are at two voltages—45 and 70 volts. Standard welder is for 230-volt, 60 cycle operation. Size welding rod recommended is 1/16-in. to 5/32-in. Primary current 1.75 amps. no load, 52 amps. full load. Ideal Commutator Dresser Co., 1041 Park Avenue, Sycamore, Ill.

Fluorescent Fixture

These fluorescent fixtures can be used for surface mounting for low ceiling interiors and also to improve arrangement and add variety to installations that include suspension type fixtures. Model No. 2029 is an open type unit employing two 40-watt 48-in. mazda F lamps; Model No. 2030, also open type, uses four 40-watt lamps. They have standard approved ballasts, starters and sockets and are power factor and stroboscopic corrected. Both bear Fleur-O-Lier and Underwriters' Laboratories labels. Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago, Ill.



MITCHELL SURFACE MOUNTING FIXTURES

Receptacles

A new receptacle cover fitting, No. 3046, is now available. It is for mounting standard 50-amp. Twistlock industrial receptacles in No. 3000 Wiremold raceway as part of a complete power outlet system for industrial use. The Wiremold Company, Hartford, Conn.

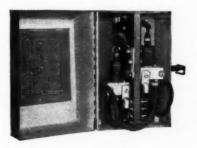


WIREMOLD RECEPTACLE

Ignitron Tube

15

This new ignitron tube, Type GL-415, for resistance-welder control, utilizes a unique water-cooling system. New tube depends for its cooling upon a special clamp into which it is fitted. Consisting of brass block with water passages, clamp not only serves as cooling medium but also cathode connection. Removal and replacement of tubes may be made easily and quickly as there are no water connections to the tube itself. A pair of tubes is capable of controlling 265 kva. of resistance-welding load on a 5½ per cent duty cycle. Can be used at reduced rating with air cooling, when desired. General Electric Company, Schenectady, N. Y.



G-E IGNITRON TUBE



Deltaglass Magnet Wire Combines All These Qualities

Whenever or wherever you have a "tough" winding problem which requires the utmost in magnet wire, investigate Deltaglass.

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They will operate perfectly in any temperature ranging from 125 degrees Fahrenheit above zero to 20 degrees Fahrenheit below zero.

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PARAGON ELECTRIC CO. 401 So. Dearborn St., Chicago, Ill.





[FROM PAGE 103]

Photo-Electric Relay

This new photo-electric relay, called Sun-Switch, is used to control electrical circuits in accordance with rise and fall of natural illumination. User chooses two lighting levels at which he wishes load switched on and off and adjusts calibrated dials to corresponding foot-candle readings. Housing is weatherproof drawn metal, dimensions 10½-in. by 5½-in. by 3½-in. Control circuit uses a type 921 photo-tube. Operation is from 110-volts, 50 or 60 cycles, a.c. United Cinephone Corporation, Torrington, Conn.



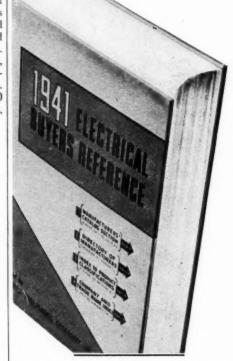
Instrument

This power resistor decade box is used in plants, maintenance departments, laboratories, engineering offices and schools. It provides a precise power resistor of anywhere from 1 ohm to 999,000 ohms, for actual use in a given circuit. It provides a power resistor handling up to 225 watts per decade. Reading for inserted resistance is read from decade dials, observing multiplying factors indicated. It is used in determining parallel resistance values, in voltage-dropping requirements, and other practical functions. Clarostat Mfg. Co., Inc., 295-7 North Sixth Street, Brooklyn, N. Y.



CLAROSTAT INSTRUMENT

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RUSH JOBS b a 1 k e d by "delivery-in-six-months," can often be solved by turning to another source of supply.

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Take Cedar Poles, for example. Under this listing, Electrical Buyers Reference gives you the catalogs of 7 companies: Bell Lumber, Graybar, National Pole, Naugle Pole & Tie, Page & Hill, Partridge Lumber, Valentine-Clark . . . and the names and addresses of 11 other companies.

Use your Electrical Buyers Reference regularly
—to save time and money

ELECTRICAL BUYERS REFERENCE

A unit of the McGraw-Hill Reference Service 330 West 42nd Street New York, N. Y.

Industrial Fixtures

These two new fluorescent fixtures are designed for use in the industrial field. Both are dual lamp types. One provides for two 40 watt lamps and the other for two 100 watt lamps. Fixtures are constructed of heavy guage lead coated metal with baked on finishes. Reflecting surface is coated with special Van Dyke colortone enamel. Curvature of lamp housings give maximum diffusion and full operating intensity. Van Dyke Industries, 2857 South Halstead St., Chicago, Ill.



VAN DYKE FLUORESCENT UNIT

Reflector Spacers

These fluorescent show case reflector spacers are designed to fill gaps between reflectors. They provide a continuous reflector from one end of show case to the other when using Wiremold No. 2100 fluorescent show case lighting equipment. Available in 3-in., 6-in. and 9-in. lengths with knock-outs to accommodate FS starter switches. The Wiremold Company, Hartford, Conn.



WIREMOLD REFLECTOR SPACERS

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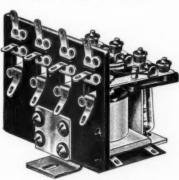
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941

A 4 pole double throw relay has been added to this line of type "C" relays. Operating voltages under normal conditions range from 2 to 230 volts a.c. and 2 to 125 volts d.c. Normal contact capacity is 10 amperes on non-inductive a.c. loads but special contact materials for specific applications may permit control of considerably higher current. Overall dimensions of this relay are 2-9/16-inches long, 2½-inches high and 2½-inches wide for normal applications. G-M Laboratories, Inc., 1735 Belmont Ave., Chicago, Illinois.



G-M 4 POLE RELAY

Electrical Contracting, June 1941

How to wire . .

residential, farm and industrial buildings

. . . for light and power

Step-by-step methods fully and simply explained in this new single, sensible book—showing you:—

- the ABC of electrical science
- the basic materials and jobs of wiring
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Here is a complete course of instruction for those who want to learn how to do electrical wiring. Begins with very first elements and takes the reader by easy steps, plain instructions and methods, to the completion of typical wiring jobs in accordance with official requirements of the 1940 National Electrical Code. Employs simple language; confines mathematics and theory to the minimum necessary for understanding of the work; covers medium voltage jobs of the types that are most in

types that are most demand.

33 understandable chapters cover:-

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For and Why"... simply address Graybar Electric Company, Graybar Building, New York, N. Y.

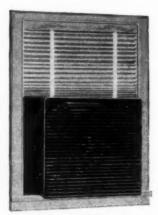
GRAYBAR IN OVER 80 PRINCIPAL CITIES



[FROM PAGE 105]

Ventilator

This unit is a window ventilator suitable for use in small homes, stores and apartments. It produces 5100 C.F.M. and is powered by a h hp. motor. Its features include all-steel cabinet in walnut finish; louver type grille with blades that can be quickly adjusted to direct air flow up or down; and reversing switch permits either air intake or exhausting. Unit can be installed in windows from 27-in. to 42-in. wide, window spacers are optional equipment. Unit is insulated to absorb vibration and deaden sound. Air Controls, Inc., 1933 West 114th St., Cleveland, Ohio.



REX-AIRATE VENTILATOR

Infra-Red Lamps

Three new infra-red heat lamps have been developed. Two of the lamps are clear, for use with standard gold-plated or Alzac reflectors and the third is built with its own reflector lining sealed inside to keep it free from oxidation, dust, dirt and fumes. All are 250-watts. Wabash Appliance Corporation, 335 Carroll St., Wabash Brooklyn, N. Y.



WABASH INFRA-RED LAMPS

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hard and epensive. Use the Wodaci "Do-All" Combination Electric Hammer and Drill and drill 15 times as fast in concrete and mason ry. Two tools in one. With hammer researches the control of the control



tools in one.

With hammer member removed it's an electric drill with 1/2" chuck. Cuts cost of drilling for expansion anchors. Universal motor 110 or 220 v. Ask for Bulletin.

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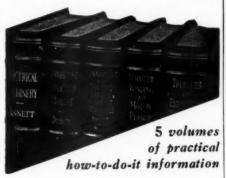
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2042 pages, 1721 illustrations and diagrams

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return the books postpaid.

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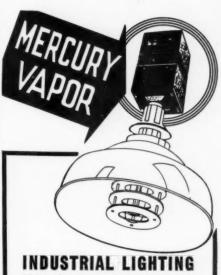
WAGNER KITCHEN VENTILATOR

Tester

This pocket size tester is designed for electrical appliances. The tester is plugged into the line and the appliance into a receptacle provided on face of tester. Two 2-position toggle switches and 3-position rotary switch then permit selection of type of measurement and meter range desired, with all measurements of voltage, current and power consumption provided by multi-scale a.c., d.c. meter. Heavy duty terminals are provided for current values in excess of appliance ratings. Eighteen measurement ranges are provided. These include a.c. and d.c. line voltage up to 250; four d.c. ampere ranges to 25 amps. and the same for a.c.; four d.c. watts ranges to 3000 watts and duplicate a.c. ranges. Also used for making power measurements of motors up to several horsepower. Radio City Products Co., 88 Park Place, New York, N. Y.



RADIO CITY TESTER



Hi-Intensity Mercury Vapor Lighting, in addition to providing more useful light at less cost, is ideal for many types of industrial manufacturing and assembling operations. The tendency to make metal parts stand out in minute detail offers advantages which speeds inspection and saves time. But remember, the many advantages of Mercury Vapor lighting directly depends upon transformer performance. Insist upon Acme Powered Mercury Vapor lamps and get the most useable light for your money.

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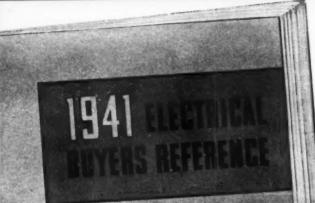
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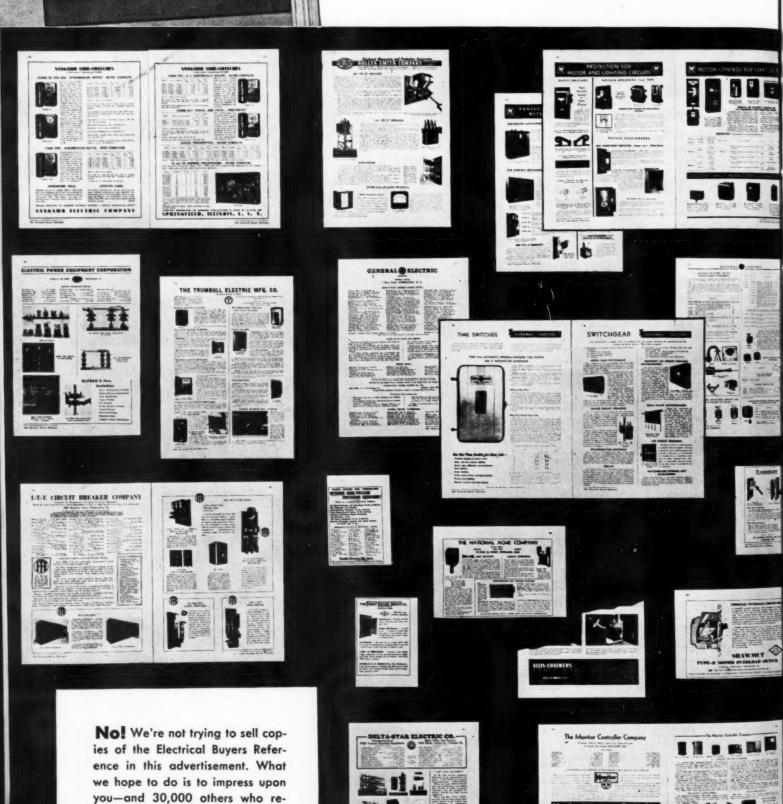
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Just to show you the sort of material included in these condensed catalogs we've reproduced some of those relating to switches and circuit breakers · . . some of the catalogs referred to in the index listings above.

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The new design-as passed by the Underwriters' Laboratories May 1, 1940.

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ILSCO COPPER TUBE AND PRODUCTS, INC. 5629 MADISON ROAD --- CIN.O.



[FROM PAGE 107]

Time Controller

This new time controller is for automatically controlling operating period of attic fans, store lighting, refrigeration systems, etc. It may be set to close a circuit for any period of time from 1 to 11 hours by twisting knob on front of in-When time period has elapsed. strument. switch will automatically open and break circuit to electrical load. Controller is equipped with snap action single pole double throw switch. Arranged for flush mounting in standard two gang outlet box. Contact capacity will handle electrical loads as high as 1 hp. or 10 amps. 30 110-volts a.c. and 11 hp. or 5 amps. at 220volts a.c. Minneapolis-Honeywell Regulator Co., 2950 Fourth Av. South, Minneapolis, Minn.



MINNEAPOLIS-HONEYWELL TIME CONTROLLER

Motor

This new fractional-horsepower motor has been built to meet the requirements of machine tools and other industrial applications where frequent start-stop service, plugging and metal-dust atmospheres are encountered. It is available in 1-, 1-, 1and 1-hp. sizes for operation on threephase and d.c. systems. Motor is of totally enclosed construction. Some of the features include cast-iron base; closely machined endshield and stator rabbets; Formex wire insulation; ball bearings; indestructible cast-aluminum one-piece rotor and anchored windings. General Electric Co., Schenectady, N. Y.



SEARCHLIGHT SECTION

(Classified Advertising)

Employment : : Equipment

Business : : (Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

15 CENTS A WORD, MINIMUM CHARGE \$3.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Bos Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is \$8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured %" vertically on one column, 3 columns—30 inches—to a page.

EDUCATIONAL

AVIATION NEEDS ELECTRICIANS urgently for electrical installation work in aircraft manufacturing. Your previous experience, plus short, special aircraft fraining, leads to these interesting, good-pay jobs... which include radio and instrument installation. Training also is foundation for lifetime career in aircraft industry, in airline instrument maintenance work, or in Civil Service at Army and Navy aircraft maintenance depots. Write American School of Aircraft Instruments, Dept. E-6, 3903 San Fernando Road, Glendale, Calif.

WANTED

ANYTHING within reason that is wanted in the field served by Electrical Contracting can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

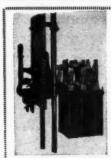
USED EQUIPMENT

ANOTHER OPPORTUNITY FOR ELECTRICAL DEALERS

You can buy completely overhauled and performance tested electric motors, generators, transformers, MG sets, welders, platers, etc., from Moreco and Resell at competitive prices and still make plenty profit. Send us your inquiries. We co-operate with dealers.

Here's a Bargain-Can you sell it? 125 KW., General Electric Motor Generator Set, type CD, 125 volt generator driven by type KT 559, 3 phase, 60 cycle, 1200 RPM motor. A Real Bargain. Write.

THE MOTOR REPAIR & MFG. CO.
560 Hamilton Ave. Cleveland, Ohio



OIL SWITCHES AIR CIRCUIT BREAKERS TRANSFORMERS COMPENSATORS BOUGHT-SOLD

CIRCUIT BREAKER COMPANY

Installing The Fluorescent Job

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[FROM PAGE 25]

margin of capacity for the fluorescent lamps than for other illuminants.

For other than regular 60 cycle alternating current, special designs of ballasts must be used. Where the wise contractor will use say the 40 watt fluorescent lamp, some wiring economies on industrial jobs can be effected in the 208 or the 240 volt range systems. But with correct ballasts, there is no difference in life or efficiency for lamps used on high voltage or average voltage branch wiring.

Effect of Voltage

No normal voltage surges are apt to occur sufficient to cause fluorescent lamps to drop out of operation. If so, they will immediately relight. Moreover, they cannot be dimmed by reduced voltage over any appreciable range of brightness. A 25 per cent reduction of line voltage will cause most fluorescent lamps to drop out. But down to that point there is some two per cent reduction of light for each one per cent voltage drop. The color will not change.

The stroboscopic flicker of the fluorescent lamp on alternating current is not considered bad for the eyes. But it is a nuisance and single fluorescent lamps should not be used in lighting rapidly moving objects. In commercial and industrial installations, the twolamp ballast systems are especially advisable, since the peak of candlepower of one lamp of the pair is staggered with the other lamp. In this way, practically no stroboscopic dancing or flickering is noticeable on the work. If three-phase distribution is available, stagger adjacent lamps on the different legs or phase wires.

Direct Current Operation

Operate fluorescent lamps on direct current only as a last resort. Such use is apt to be limited to where the color is a very important consideration and is of doubtful economy. Then special resistors must be used, and lamps not larger than the 20 watt, 24 inch size. A preferable combination on d.c. is a pair of 14 watt, 15-inch lamps in series with a 60-volt 0.5 amp. S-11 bulb ballast filament lamp.

No less than 18,000,000 fluorescent lamps will be sold in 1941. Good contractors-a lot of them-will be kept busy.

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction—Maintenance—Renairs

FUSE EXTRACTOR POST

For 3 A G fuses. Black backelite body, red extractor knob. Meets Underwriters' Specifications. Tool or finger operated types. No exposed parts. Takes panels up to 5/16" thick, ½" mtg. hole. Length 134" from front of panel, 2-1/3" overall. Littelfuse Catalog.

Littelfuse Catalog.

LITTELFUSE, INC.
89 N. Ravenswood Ave. Chicago, III.



SODERING PASTE Fast working—Corrosion-free.
Assures secure electrical and
mechanical joints. Triples
strength of the soder. National Underwriters Laboratory approved listing.
L. B. ALLEN CO., Inc.,
6731 Bryn Mawr Ave.,
Chicago, III.



New WHERE-TO-BUY Advertisements

received by June 20 will appear in the July Issue, subject to space limitations.





Louvered Fleur-O-Lier for 5-ft. Tubes

Certified and approved by Electrical

Testing Laboratories.
Recommended for commercial installations-stores, offices and public buildings.

Offer a new and better solution of many lighting problems.

Write for Booklet EC-61

Good territories open for manufac-turers sales representatives.

R & W WILEY, INC. 777 Hertel Ave. Buffalo, N. Y.





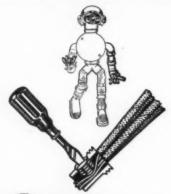
WHERE TO BUY

May be a question that comes up frequently in connection with special equipment, materials or supplies needed on electrical construction, maintenance or repair work. If this or other advertising in this issue does not supply the answer write

ELECTRICAL CONTRACTING

330 West 42nd Street

New York, N. Y.



The RATTAN Man Says:

"Many modern industrial fixture lighting circuits now require No. 12 wire, You can make these connections with

The MARR NO. 2 solderless connector the per and better than with tape, solder and torch."

A Perfect Joint Connector
(Cap Made of Bakelite)



. . . and a permanent one, too. Simply in-sert the wires, turn on bakelite cap, and tighten with the screw driver.

Send for free samples. See Your Electrical Dealer Approved by Underwriters

THE RATTAN MANUFACTURING COMPANY

522 STATE STREET
NEW HAVEN, CONN., U. S. A.
GENERAL SALES AGENTS HATHEWAY AND CO.
75 MONTGOMERT ST., JERSET CITY, N. J., U. S. A.

Sturlevant ts Air to Work



Sturtevant Design 7 Propeller Fan Made in sizes 12" to 45" inclusive Capacities -680 to 15,450 c.f. m. Direct connected motors A V. Propeller Fans also available with belt drive







Atticvane Fan Pressure Blower Ventilating Set





Wind-O-Vane Fan

Wallvane Fan

STOCKS CARRIED AT MANY POINTS

B. F. STURTEVANT COMPANY Hyde Park, Boston, Mass. Branches in 40 cities

DISTRIBUTOR FOR SOUTHEAST:

NOLAND COMPANY, INC.
Virginia South Carolina District of Columbia
North Carolina Maryland Georgia Alabama

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★ These companies have supplied additional buying information on their products in the 1941 edition of the Electrical Buyers' Reference. SQUARE D Offers

A NEW LOW COST
INDUSTRIAL
MULTI-BRERKER

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A COMPACT CIRCUIT BREAKER TO MEET ALL 230 VOLT A. C. REQUIREMENTS

No parts to replace after short circuit or overload.

Thermal element (bimetal) affords time lag on momentary overloads. New magnetic feature assures instantaneous trip on heavy short circuits.

Window signal on name plate indicates "tripped."

Breaker units are common trip—cannot cause single phasing of circuits.

Front operation permits close ganging.

Provision for padlocking in "on" or "off" position.

Dust-resisting construction; felt gasket between box and cover.

Compact—50 ampere size measures only 11%" high x 65%" wide. The 100 ampere size (as illustrated above) measures 13%" high x 9%" wide.

Immediate Delivery On All Sizes -Notice Low Costs

2-Pole 3-Pole Frame Size List Price List Price 15-25 \$10.00 \$15.00 35-50 19.00 50 Ampere 14.00 33.00 24.00 50-100 100 Ampere

Your Square D distributor is displaying and stocking the new Multi-breaker. Ask him for details or write us for Bulletin 3200.

ZOUBEE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CALL IN A SQUARE D MAN



EARNEST PROPOSALS are ACCEPTED

Just as earnest marriage proposals made by young men throughout the ages have been accepted by young ladies, so earnest proposals for good wiring made by electrical contractors will be accepted. Today, especially wiring proposals backed up with good designing and materials will be welcomed by customers. Good, dependable wiring is needed in the many buildings about to be erected.

GENERAL ELECTRIC WILL HELP YOU

A G-E handbook on modern industrial wiring practices and another G-E handbook on modern residential wiring practices are available free. One is called "Adequate Wiring for Industry," the other is called "G-E Home Wiring Handbook." These handbooks will help you to plan efficient wiring and to make use of recent developments.

The G-E line of high quality wiring materials is complete, including conduit, wire and cable and wiring devices. These materials give dependable service. They are made to be used together and can be installed quickly. Moreover, G-E Merchandise Distributors are located at all key points in the country. You can obtain G-E wiring materials right in your own territory.

WRITE FOR G-E HANDBOOKS

For further information about G-E wiring materials or for copies of the handbooks see the G-E Merchandise Distributor nearest you or write to Section CDW-186, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.



